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Department of Agriculture

OF

WESTERN AUSTRALIA.

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FOREWORD.

By the Hon. M. F. TROY, M.L.A., Minister for Lands and Agriculture.

To all Fellow-farmers, Agriculturists, Pastoralists, and Men on the Land,—

I desire at this, the festal period of the year, to extend to you my warm congratulations on achieving the reward of a bountiful season.

Never in the history of the State has there been such activity in the agricultural industry; never has Western Australia enjoyed such prominence and popularity; never has she appeared more alluring to the aspiring settler, or more desirable to the practical farmer ambitious to place his boys on the land. In the Eastern States the slogan to-day peals louder than ever—"Go West, young man: Go West."

Western Australia is the one State in the Commonwealth giving evidence of remarkable progress in land settlement and rapid development of production, and our total area under crop this season amounts to 3,324,523 acres, an increase over the previous year of 392,413 acres. Over 2,000,000 acres of our soil have been conditionally acquired during the year for the purpose of agriculture and grazing. 3,430 applications for land were dealt with by the Land Board, and 1,107 new settlers added to our ranks. More than 10½ millions of acres of pastoral lease have been granted, bringing the total area now held under this title to 229,970,629 acres. 52 surveyors are busily at work preparing fresh holdings, soon to come under the plough or pasture. We are enjoying an era of agricultural and pastoral progress and prosperity. To crown all we have been blessed with ideal conditions

for crop production, and will assuredly excel all previous harvests in our grain areas. In many places highly satisfactory results have been obtained, notwithstanding indifferent tillage to some extent inevitable, due to the large areas brought under cultivation.

And what does it all prove? Simply this: That we have the land, we have the climate, and above all we have, and are yearly adding to, the sturdy manhood of our rural populace. For, in all the combination of our fortunate circumstances, it has been the individual effort of each farmer and his employee that has produced the goods. The Government has sought sympathetically to assist the landholder to the utmost of its power; the Department of Agriculture has spared no efforts to supply the best advice on practical farming methods; and the farmer has nobly responded. On such co-operations powerful nations are built up. Our past achievements have been great, but our limits are not yet in sight.

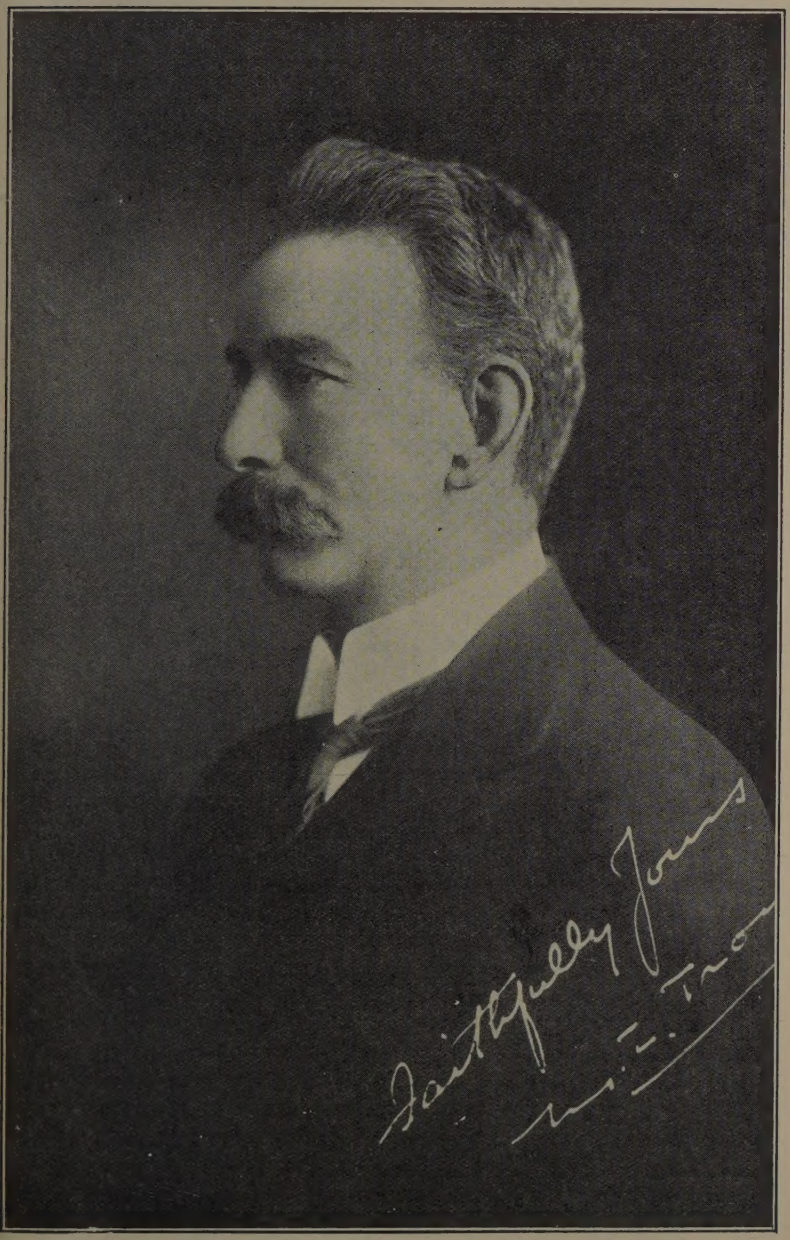
My message to you is this: Keep in the van of progress. We cry for no new Worlds to conquer; we have in keeping a glorious heritage for our development; an assured future if we but sustain the high courage that has led us to our present point of vantage.

The Government is your Government, and its best interests are best served by serving your interests. Its hopes and aspirations are bound up in you and your future, and its objectives identical with your own, *i.e.*, the development of every acre of soil up to its highest degree of productive power.

Holding fast to the success you have already achieved, I earnestly hope that the coming year will bring to each of you happiness and further prosperity, brighter prospects and more inspiring realisations, in wishing you which I beg to subscribe myself,

Yours very sincerely,

M. F. TROY,
Minister for Lands and Agriculture.



Hon. M. F. Troy, Minister for Lands and Agriculture.

BY THE WAY.

(The Editor.)

This issue of the "Journal of Agriculture" will complete Volume 4 of the Second Series, while it also synchronises with the close of the year 1927. The volume may be said to comprise an epitome of, not all the work done by the Department of Agriculture, but of some of the diverse experiments proved by it for the benefit of the agriculturist, the horticulturist, and the pastoralist; of encouraging competitions for the improvement of farming methods, and for the increase of the soil's productivity. The knowledge it diffuses is intended to help mankind to increase the production of the land, and to multiply to abundance the chief requirements of man's sustenance; to carry a bigger population and a happier race; to provide an outlet for the over-crowded portions of the Empire; to create employment in the wide and sparsely occupied spaces of our State, and to establish friendly commercial relationships between the people of Western Australia and those of other parts. It aims at improvement in the class of wool for man's clothing and the type and quality of our stock and poultry, and products.

The functions of a Department of Agriculture are based on a benevolent intention inspired by the highest patriotism and humanitarianism. The institution crystallises the expressed thoughts of statesmen in all civilised countries. Its objects aspire to the highest ideals of the human mind—the intense development of the sources of man's supply of food and clothing till there may be an assured sufficiency for all the world; that hunger may be banished and total famine abolished; that comfort may be increased and all the races of the world live in peace, harmony, and security, springing from a universe unenvious and surrounded by a plentitude of life's sustenance. The evolution of thought in this direction has created in nearly every country in the world of commerce an institution which is in effect a Department of Agriculture, call it by what name you will. Its operations are in close similitude throughout. Each has its system and its control, but in the main they correspond.

In this State the Department's policy is controlled by a Minister of the Crown, while the work of the Department is under the Director of Agriculture who carries out that policy, comprehends the whole, and allots to each expert his own particular sphere and duty for the time being. The work itself is for the most part individual, and forms a record of facts as they are discovered. There is no incentive to thesis, and where such appears it is plainly stated as a probable result to be achieved by following as indicated certain lines of applied method. Where lines of direction are given for the guidance of the agriculturist and his contemporaries

in allied industries, there may be a complete assurance that nothing speculative is advanced, but the advice is based on results tested and proved time and again.

It has been the aim of the "Journal of Agriculture" to deliver these truths to every farmer in the country who is sufficiently interested to become a subscriber, and the growth of its circulation and popularity afford the best evidence of its general appreciation. The contributors to its pages on the departmental staff have striven hard to give of their best, and if, in the general scheme of life we have not yet reached that utopian stage where—

"No one shall work for money,
And no one shall work for fame."

The Editor can thankfully pay them this tribute, that they have been imbued with the spirit expressed in the further quotation from Kipling's lines, and their tasks performed by—

"Each for the joy of the working
And each in his separate star,
Painting things as he sees them
For the God of things as they are."

It is appropriate that this tribute should be paid them at the close of Volume 4—the passing of another milestone on the road of progress so far as the agriculturist of this State is concerned. Nature has been in a most generous mood, and the earth, blessed by a magnificent seasonal rainfall, has burst into a golden harvest auguring a crop surpassing in magnitude anything ever before known in this part of the Commonwealth.

A paternal government announces that the Agricultural Bank is liberalising its scheme of advances to farmers enabling assisted settlers to acquire land further from the rail head than heretofore. Survey staff has been strengthened, and the work facilitated. Blocks suitable for tropical agriculture have been surveyed. Two more railways are being pushed out to further enhance the agricultural industry by opening up fresh farms. It is probable that a Bill for the connection of the Wiluna township with railway communication will be dealt with by Parliament before the session closes, by which the pastoral industry must receive stimulus. Three more new experiment farms have been established, and as far East as Kalgoorlie it has been demonstrated that given favouring conditions wheat can be economically grown.

A significant step forward has been taken by the viticulturist in the first large export of West Australian wine to the English market, the quality having been already favourably discussed, and a demand for the consignment assured. There was also a record export of fresh fruit from this

State during the year, another noteworthy and gratifying event. Then the conclusion of the Wheat Yields Competitions last harvest marked another epoch in our history. Conducted over a period of three years, the average yield of all competitors attained the satisfactory crop of 18 bushels 4 lbs. per acre, or 6 bushels 43 lbs. per acre higher than the average yield for the State during the same period; the highest average yield for the competition reaching 24 bushels 17 lbs. per acre, and the highest individual yield 26 bushels 56 lbs.per acre. The importance of these results are intensified by the fact that the competition constitutes the first of its kind in the Commonwealth, which has considered, not results achieved on a particular acreage, but the resultant average over the whole farm, as determined by the merchants tally dockets. The growing popularity of our wool, too, in the markets of the world, is evidenced by the fact that of 135,984 bales offered last season 99.50 per cent. were briskly sold, while the quality of our sheep is constantly improving, and has reached that stage of perfection where both stud ewes and rams were exported to South Africa for stock improvement, these having been bred in this State.

Our dairy produce and stock have likewise increased and improved materially. In one dairy produce factory in the South-Western district the year ended with a substantial increase in business, and it is a matter for congratulation that in the past eight years this factory increased its turnover from £12,000 per annum to £115,000 per annum. At Albany the increase in two years has been no less than 186 per cent. Following upon the Government's policy of dairy herd improvement, 300 pedigreed sires ex officially tested dams, have been distributed to settlers on easy terms of payment, during the last three years. Under this policy these bulls are confined to zones, thus providing a continuity of the system of "grading up," and a marked improvement is noted in the young stock. Then there has been considerable activity in the building of silos in dairying and mixed farming areas, the popular type being the 85-ton reinforced concrete silo. Top-dressing of pastures, too, is becoming practically general throughout the State, as the result of experimental work conducted at various centres during the past four years. At 65 centres the average increase following the application of one cwt. of superphosphates per acre, has been 263 per cent. Truly it has been a year of advancement, for which to be thankful and of which to be proud.

By the time this number of the Journal is issued the man on the land and his brave women folk will be looking forward to the Christmas and New Year. Christmas has an abiding appeal to the Christian races, and it is marked by all but the Gabriel Grub's of our community—and they should be few and far between among farmers this year—by an ebullition of generous sentiment. The failures of the past are all forgotten, and only the successes remembered. Fancied slights and hasty misjudgments are

buried; geniality and benevolence hold sway; the door is wide open to the stranger and the guest; welcome is boisterous and hand grips fervent and sincere.

In our mother land Christmas has ever been a season of family reunion, of festivity, of joy and thanksgiving. Some among us will recall those happy occasions with tender memories, and maybe visualise them with their old Wardles and Pickwicks and poor and rich relations; with the Vellers and Winkles and coquettish Arabella Allens, and the lady with the fur-topped boots, once displayed, ah me! with delicate modesty and the crimsoning blush. But for the farmer out West there is little time for festivity at Christmas. Not his to skim the ice-bound surface of the lake beneath the frosty moonlight, a million spangles reflecting radiance from the branches of environment, the crisp air impinging against his glowing cheeks and his heart throbbing to the touch of that dear divinity meticulously reposing in the half circlet of his supporting arm. There is man's work for the farmer here at Christmas time, and in the summer's heat he must toil and sweat that his crop be harvested and the reward of his labour garnered; thankful that there has been such a bountiful season. But if he has put behind him the Old World Christmas sport and merriment (hands across and up and down the old low-ceiled barn with its festoons of holly leaves and bright berries; its sprigs of mistletoe in the most unexpected places; feet stamping, laughter ringing, up and down, up and down, till the fiddlers are hot with exertion and the building vibrates to harmony). If he has left all this behind him in the old land he can at least share the sentiment. He need not, like Gabriel Grub, spend his nights digging graves for human hopes else the elves migrate to these antipodes and renew their vengeance upon his person. Adapting himself to his new conditions he must look for his recreation when his work is completed later in the year. And it is a good prospect. There is as much sport in the breakers of our seaside resorts and on the rippling waters of our rivers, our fairy dells in bushland, on our tennis courts and our playgrounds, as ever was on the farmsteads of the British Isles, and all these are his to enjoy when the harvest is over. But we must make cheerfulness and merriment as did our forbears. Happiness comes from within; not without.

Yes, it has been a splendid year.. We have no poor relations here; but we have our neighbours, and sentiment and benevolence can have full scope. Let the spirit of good fellowship expand throughout the agricultural areas and neighbourly friendships multiply. Is there need for charity? Not much, perhaps, but if you must have an outlet look about you. Is there a local hospital, or an orphanage near you? Is your help wanted? Of course your crop is not off yet, and you have not much surplus cash, or credit. You are just getting on your feet as it were. Well! well! That is so; but about a bag of wheat, now, or say a case of fruit, or vegetables—What? Well, we leave it to you, and we hope you will have a merry Christmas and a Happy and Prosperous New Year.

THE FRUIT INDUSTRY OF WESTERN AUSTRALIA.

Geo. W Wickens, Superintendent of Horticulture.

During the first ten years of the quarter of a century from 1901-2 to 1926-27 the area devoted to fruitgrowing in Western Australia increased rapidly, the total planted in 1901-2 being 9,705 acres, and in 1911-12 21,015 acres, or an average annual rise of 1,131 acres. In the succeeding five years the area still continued to increase but at a lesser rate, the average annual rise being 753.6 acres, and the end of that term (season 1916-17) constituted the peak year for Western Australia's fruit area with 24,783 acres. An average annual decrease of 200.3 acres took place in the next four years, followed by increases and decreases until at the present time the total area comprises 23,786 acres.

Particulars of areas from 1911-12 to 1926-27 are shown in the accompanying graph.

Fruit growing in Western Australia has developed mainly in the direction of producing kinds which are suitable for export purposes, comprising apples, pears, and oranges for shipment to overseas markets as fresh fruit, and grapes for shipment both in a fresh and dried condition.

These four kinds of fruit represent 82 per cent. of the total area, and it is interesting to note that while oranges and pears have experienced very little variation in the last ten years, apples have decreased by nearly 2,000 acres and grapes have increased by a little more than 2,000 acres.

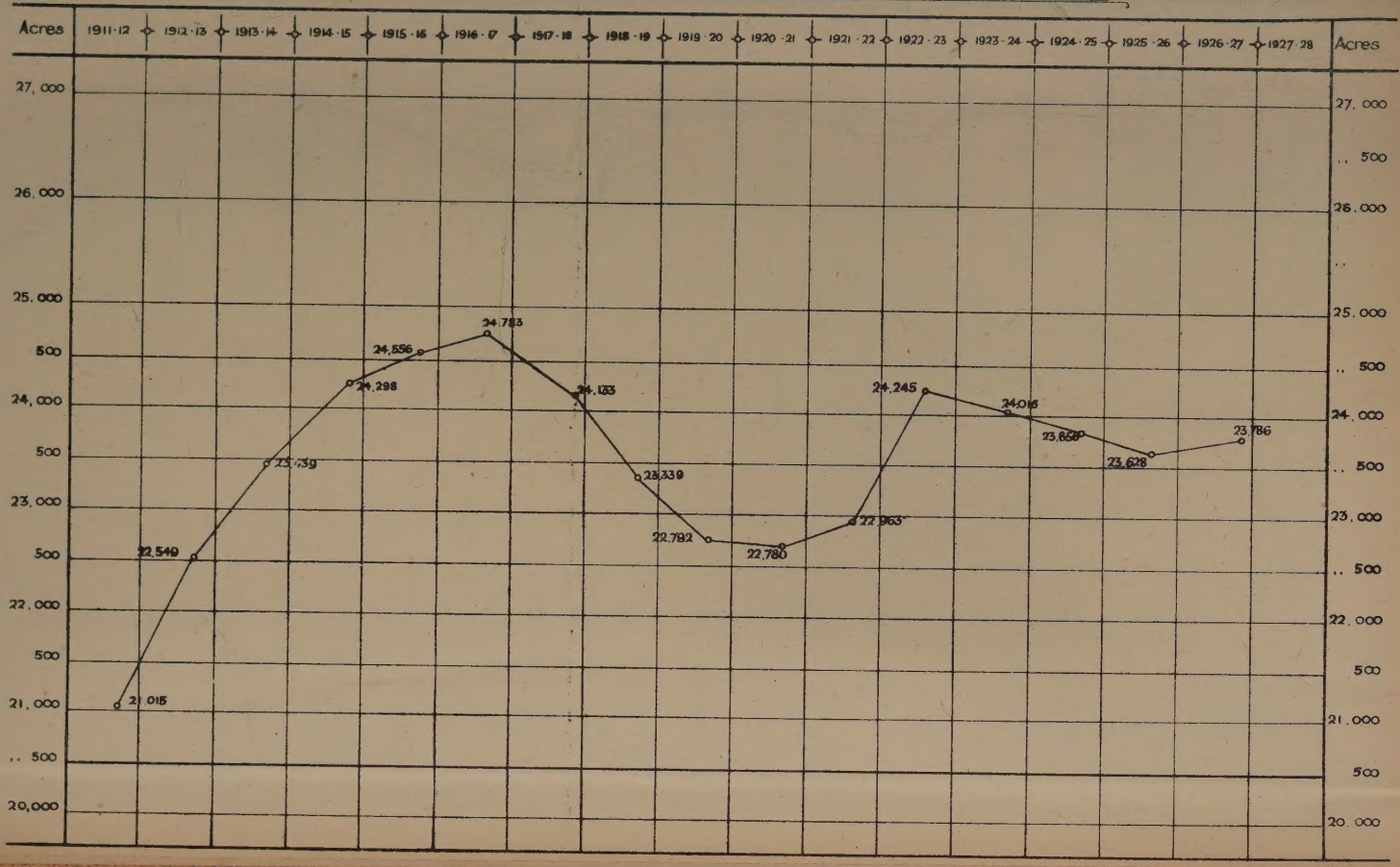
The principal reason for the decrease in the apple area is the unfortunate fact that in the earlier days of the industry sufficient attention was not paid to selecting suitable districts or suitable sites, and many hundreds of acres have been rooted out because they were planted on the coastal flats and ironstone ridges within easy distance of Perth, where either climatic or soil conditions, or both, precluded any chance of success.

Grape vines increased mainly on account of new areas being planted out to produce fruit for drying purposes, and though there is little chance of any further marked increase in area taking place in the near future for that purpose, there is every prospect of a steady increase occurring in the planting of varieties suited for production of grapes for wine-making.

Particulars of areas from 1916-17 to 1926-27 of the four principal kinds of fruits are shown in the accompanying graph.

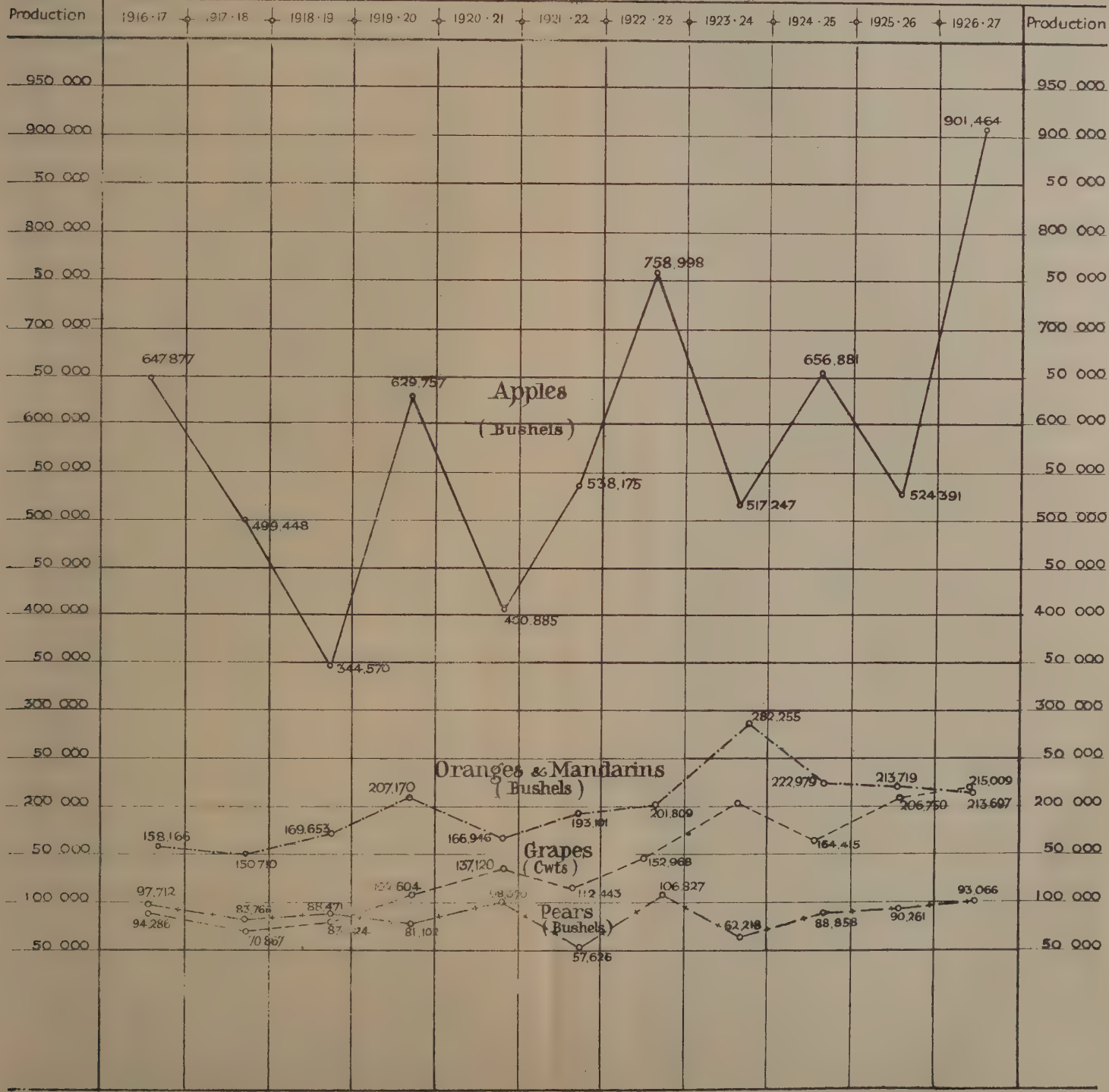
Though as shown above the area under fruit in Western Australia has decreased since the peak year of 1916-17, there has been a distinct increase in production, partly due to an increase in the number of trees which have reached bearing age, and partly to the fact that growers as a whole pay more attention to manuring and general care of their orchards than formerly, and the production per bearing tree has increased. The increase mentioned has occurred in connection with each one of the principal kinds of fruit,

Total Acreage under Fruit Trees & Vines in Western Australia for Seasons 1911-12 to 1926-27



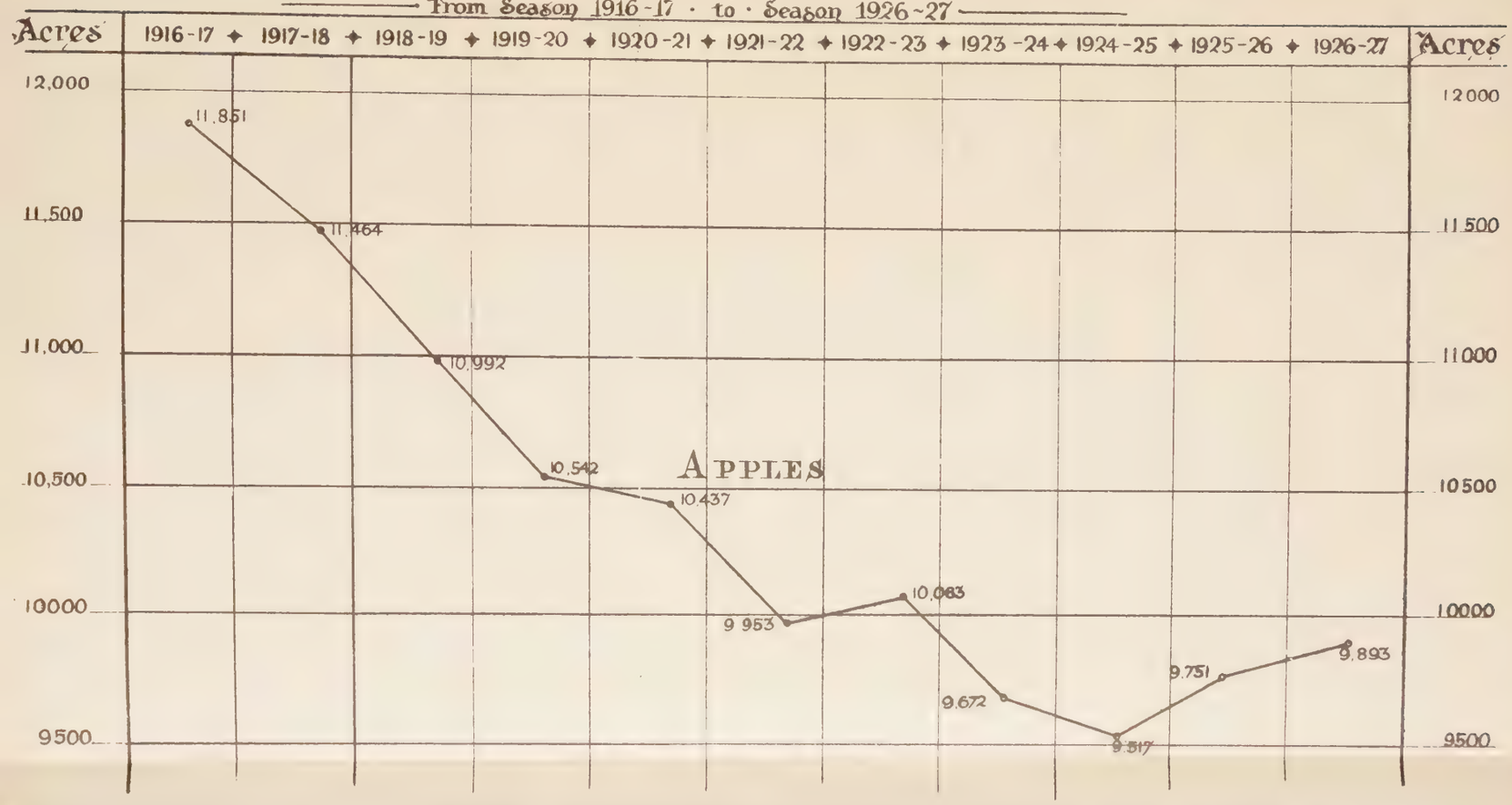
Graph showing Production of Apples, Pears, Grapes, Oranges & Mandarins in Western Australia.

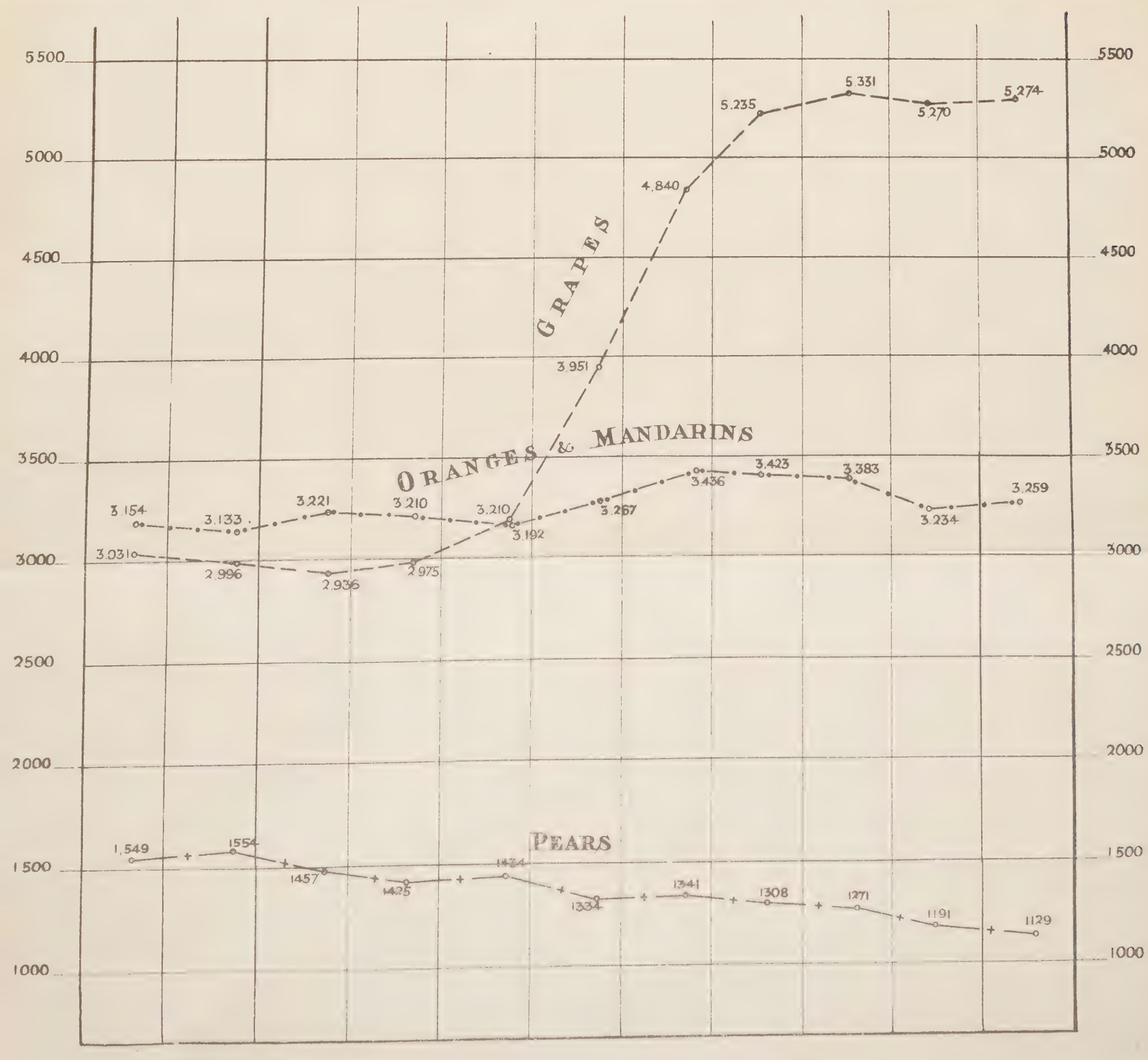
From Season 1916-17 To Season 1926-27



Graph shewing Area under Apples, Pears, Grapes, Oranges & Mandarins in Western Australia

From Season 1916-17 · to · Season 1926-27





even with apples, in spite of the big decrease in area. The average annual crop of the last five seasons, when compared with the annual average crop for the previous five seasons, is as follows:—

Apples—

1922-23 to 1926-27 inclusive—Annual average, 671,796 bushels.
1917-18 to 1921-22 inclusive—Annual average, 482,567 bushels.

Oranges and Mandarins—

1922-23 to 1926-27 inclusive—Annual average, 226,891 bushels.
1917-18 to 1921-22 inclusive—Annual average, 177,516 bushels.

Pears—

1922-23 to 1926-27 inclusive—Annual average, 88,246 bushels.
1917-18 to 1921-22 inclusive—Annual average, 81,807 bushels.

Grapes—

1922-23 to 1926-27 inclusive—Annual average, 188,175 cwts.
1917-18 to 1921-22 inclusive—Annual average, 104,880 cwts.

Particulars of production of the four principal kinds of fruit from 1916-17 to 1926-27 are shown in the accompanying graph.

CHICKEN POX.

W. T. RICHARDSON, P.A.

Chicken pox, also commonly called Warts, is a disease of the unfeathered portions of the head and its adjuncts, namely the comb, face, and wattles. Chicken pox may affect turkeys, pigeons, and fowls. It has also been reported in geese.

The disease is caused by a filterable virus. Such a virus is one that is so small that it cannot be seen under the microscope, and will pass through the fine filters visible germs will not pass.

Experimental inoculations conducted in research laboratories tell us that the one filterable virus or germ will cause the diseases which have been termed chicken pox, contagious epithelioma, ulcerative sore eyes, canker and avian diphtheria (diphtheric roup). Some authorities suggest, however, that the above diseases may be caused by the presence of a combination of two or more filterable germs.

This disease is rare in cold climates, but frequent in hot climates and generally appears in late summer, autumn, and early winter amongst the young susceptible birds. The old birds that have passed through the disease are immune. Some have a natural resistance and do not develop the disease, which in some seasons is more severe than in others. It is one of the seasonal diseases, and can be controlled or minimised in virulence to a large extent by the adoption of the following treatment:

From early January give Epsom salts in the drinking water twice weekly for three consecutive weeks at the rate of one ounce to the gallon of water. Then alternate for a similar period with sulphur in the mash (wet or dry mash) twice weekly, at the rate of one ounce to every 50 birds. Continue this treatment till about the end of May. Disinfect the houses, perches and nest boxes once every month during the above period.

The first sign of the disease is a small red pimple on the comb, face or wattles. The nodules vary in size from a pin head to the size of a pea or even larger. Later these nodules ulcerate in the surface. As the nodule heals it appears as a dark, later a black scab-like mass Finally the scab drops off leaving a scar. At times, when treatment is delayed, the scab may extend over one or both eyes, and may cause the loss of one or both of them. The bird being unable to see, death follows—caused by starvation. This disease may be followed with roup and with canker of the mouth.

Treatment.—Isolation of affected birds as the disease is highly contagious and infectious. Remove the warty growths and paint affected parts with tincture of iodine every third day. A mixture of carbolic oil and tincture of iodine in equal parts has also been found very effective.

If the eyes are affected bathe them thoroughly daily with permanganate of potash (Condy's crystals) in 2 per cent. solution, remove the scab, douche the eye with said solution, dry off and apply carbolised vaseline or carbolic oil. Examine the mouth and if canker or roup lesions are present paint them with muriatic tincture of iron every alternate day. Birds badly affected about the eyes and unable to see to pick their food should be hand fed.

After handling sick birds the hands should be thoroughly washed to prevent accidental transmission by the hands to healthy birds

Should chicken pox make its appearance before preventive methods have been adopted, the following is recommended: disinfect houses, perches, and nest boxes. Add Condy's crystals to drinking water twice daily and finely minced raw onions to the morning mash, likewise 2 ounces sulphur in the mash twice weekly for every 50 birds, and alternate weekly with Epsom salts in the drinking water at the rate of one ounce to every gallon of water till all birds have completely recovered.

When canker or roup lesions are present in the mouth or throat feed mash only till the birds have recovered.

Pox virus is very resistant to the action of disinfectants, therefore treatment of the houses, etc., should be frequent and thorough.

GREEN FEED FOR POULTRY.

W. T. Richardson,

Poultry Adviser.

An abundance of green feed all the year round helps to keep the hens in good laying condition. Plenty of green feed will ensure an increased egg production at a reduced cost.

Green feed also supplies the necessary bulk that helps to develop the digestive organs of a pullet. Good digestive organ development spells greater capacity for food, which in its turn means greater laying capabilities. The egg being produced from the food consumed by a hen, it stands to reason that a high producer must be a heavy eater.

On the other hand, heavy eaters are not all prolific layers of eggs. This applies in particular to the heavy breeds, such as Orpingtons, Plymouth Rocks, Rhode Island Reds, etc. Some birds run to fat instead of producing eggs, and an abundance of green feed will, to a large extent, check that tendency.

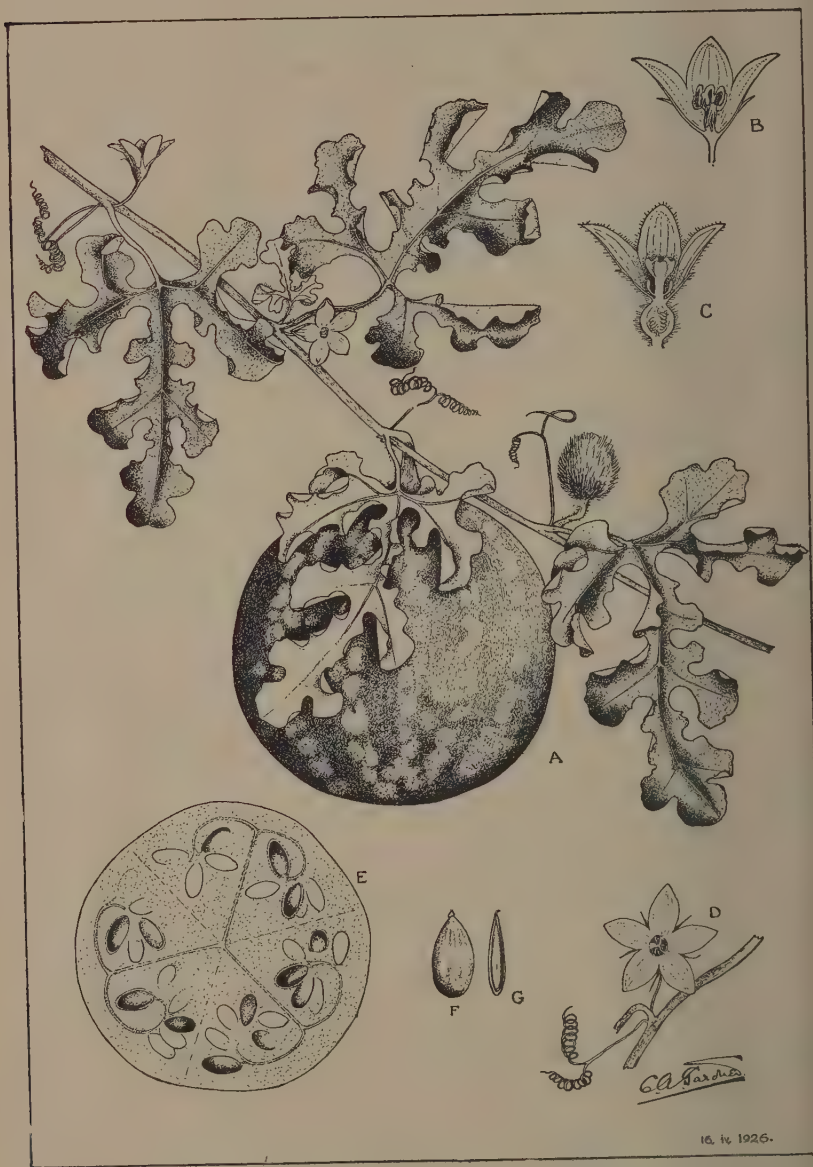
Give your breeders all the green feed they will eat, morning, noon, and after their evening grain. This will help to reduce "dead-in-the-shell" to a minimum, and the chicks will be bigger, stronger, and will get a good start in life.

When chickens are about ten days old introduce green feed into their ration. It should be tender, succulent, fresh cut, and as low in fibre contents as possible. Excess of fibre will cause indigestion, retard their growth, and undermine their constitution. Lettuce, chickweed, rape, etc., are most suitable, tied up in bundles and hung just within their reach. It is surprising how much green feed they will consume. Green barley cut up fine and incorporated in their mash is also recommended.

Chick runs should be made ready before the hatching season, by turning over the ground and sowing with rape seed. There will then be a supply of green feed for the youngsters to pick at, also the ground will be considerably sweetened.

Some of the most suitable green foods for poultry are lucerne, berseem clover, lettuce, rape, cabbage, kale, cape weed, silver beet leaves, green barley, etc. Green maize and sorghums are high in fibre contents and low in proteins, and consequently they are not desirable for best results.

At the Muresk Egg Laying Competition the birds have been fed, from the commencement of the test, 50 per cent. green feed in their morning mash, as much green feed as they can eat at midday, also after their evening grain. The monthly averages given elsewhere in this issue of the "Journal" indicate that, under local conditions, green feed should constitute at least fifty per cent. of a hen's diet.



Wild Melon. (*Citrullus vulgaris*, Schrad.)

A. Portion of plant. B. Male flower. C. Female flower. D. Flower and tendril.
E. Section of fruit. F. Seed. G. Section of seed. (All much reduced.)

WILD, OR AFGHAN MELON

(*Citrullus vulgaris, Schrad*).

W. M. Carne, F.L.S., and C. A. Gardner.

This plant, native to tropical and sub-tropical Africa, has many forms, including the ordinary Water Melon, the Citron, or Pie Melon—also known as Pig Melon—and the form dealt with here, which approximates to the Pig Melon, but the fruit is smaller and of a bitter flavour.

The Afghan Melon was first brought to our notice in April, 1925, from the Meenaar district, and it was stated to have been introduced by Afghans about 20 years previously. Mr. W. G. Burges, of the York district, writing about this time, stated that it was a serious weed between Seabrook and Grass Valley, and that there were also patches near Spencer's Brook. It is also stated that stock will not touch it and that it grows freely on fallowed soil.

It is only in the Meenaar and Grass Valley districts that this weed has been noticed as of importance. If it is as serious as reported, settlers would be wise in eradicating the same, or checking its spread.

Description of Plant.

An annual trailing vine, spreading to several feet in diameter; hairy, with soft hairs. Leaves stalked, usually under 3in. long, the upper ones three-parted; the middle segment sinuately lobed; the lateral segments 2-lobed. Flowers yellow. Fruit more or less globular, usually 3in. to 5in. diameter; the rind green with lighter patches; the flesh white and firm; the seeds black when ripe.

JARDEE SETTLERS' ASSOCIATION.

FARM COMPETITION.

M. Cullity, Agricultural Adviser.

The final inspection in this competition took place during the week ending 29th October, the 14 farms visited being those of W. Hamilton, J. Crawley, J. McCosh, C. Wilkinson, C. Nelson, W. Logan, G. Dodson, G. Goulden, A. Kjellgren, W. Kjellgren, J. Prosser, C. Gartner, J. Thomas, G. Mainard.

Four inspections were originally intended, but owing to the difficulty of travelling in July this was amended so that only three inspections were made.

The result of these visits show that the first three places go to:—

A. Kjellgren, 1; J. Prosser, 2; W. Hamilton, 3, in that order.

The farms visited throughout showed a considerable amount of thought on the part of the owner, although, of course, the personal touch was much more in evidence on those leading. The judging has not been an easy process; the newness of the farms, the buildings, the fences, and the similarity of the lay-out generally have combined to make the final decision difficult.

A forward tendency towards farming can be plainly traced through three inspections, that is, while gradually more attention has to be paid towards the feeding and care of stock, so consequently less time can be put into developmental work.

It was pleasing to see that nearly all the competitors were able to conserve a quantity of clover hay to help tide them over the bad season, and also that advantage was taken of the facilities provided for the growing of green summer crops. In three cases feed was conserved as silage, and incidentally in one case this silage was the actual means of one settler getting through the months of March and April successfully.

In the beginning of March a burning off fire got away on Mr. J. Crawley's property and swept over his pastures, leaving practically nothing. However, with the silage (approximately 10 tons) and a small quantity of hay, he was able to feed his stock till the early rains caused sufficient growth again in his paddocks.

One point which might perhaps receive more attention is that of provision of clean water for stock. If water cannot be obtained in all paddocks the cattle should, by the erection of suitable races, have access to water elsewhere.

Mr. A. Kjellgren must be complimented on the high standard he set his associates. Not only in the care of his stock was he efficient but in the general lay-out of the farm, the buildings, and the husbanding of pastures and crops; while the general cleanliness and tidiness of his farm will strike even the most casual observer.

A few points *re* Mr. Kjellgren's farm may be of interest:—

The buildings and yards.—From the commencement he has looked ahead, and has also watched for symmetry and lining up of his sheds and fences. One may stand opposite his milking shed, in line with the front of it, and have in direct line also the fronts of his present hay shed and dairy, and the edge of the back verandah of his house, while the uncompleted stables and loft are also in line. The design of this stable and loft, although not new, is interesting. Here on ground level is the horse stable, machinery space, harness room and cart shed, while the upper storey when completed will serve as a hay loft. One end of this is built into the hillside so that little work will be needed to build up one end to the level of the loft floor, so enabling the hay carts to drive direct to this floor, thus saving much labour in tossing the hay to a height, thereby saving time in carting in. One cannot leave these sheds without remarking on their thorough cleanliness—the milking shed spotless, the horse stables the same, while the dairy and dairy utensils could not possibly be better.

In the fencing again, much thought has been expended. From whatever paddock the stock may be grazing, access can be had direct to running water. The race is so designed that any paddock may be shut up without causing inconvenience in transferring stock from one part of the farm to another, and throughout rectangular paddocks are aimed at

Re crops.—Mr. Kjellgren grew millet, maize, Sudan grass, and lucerne during the summer, while the cattle had for grazing a splendid flat of paspalum, white Dutch and subterranean clovers. During the wetter months, subterranean clover with rye grass has supplied the pasturage, while green lucerne and clover hay were used for shed feeding. The lucerne plot of one acre has responded so well that another one and a half acres have now been sown.

This year 14 acres of excellent subterranean clover and rye grass are shut up for hay. This was all top-dressed at the commencement of warm weather with 1 cwt. super per acre.

Mr. Prosser also deserves much praise for the amount of work that has been carried out on his farm. Perhaps the most outstanding feature is this farmer's belief in lucerne, of which he has now 12 acres sown. Ample area has been reserved for intense culture and for the growing of summer fodder. Fences and races are designed to facilitate the husbanding of pastures and the handling of stock.

Mr. Hamilton was not far behind and should receive great credit for the way in which his farm has been arranged. Mr. Hamilton (as also Mr. Crawley), being a settler under the Soldier Settlement Scheme, perhaps has not had the same opportunities for erecting buildings, etc., as the settler under the Group Scheme. However, the state of this farm on my three visits showed a very even standard in general tidiness and cleanliness and also in cropping. The buildings and general surroundings were always cared for. The stock were always in good condition and ample crops, apart from pasture, were grown. This farmer is also aiming at a good rotation; for instance, the crops at the final inspection and the crops grown previously are as follow:—

Barley—following Sorghum following Potatoes.

Oats—following Maize.

Grass and Clovers—following Peas. Will be followed by Maize.

Oats and Peas (mixed) on new land.

Last year Mr. Hamilton also tried his hand at a small stack of silage. A good sample was turned out although the loss was big owing to the smallness of the stack.

Of the other competitors, those specially deserving of mention are as follow:—Messrs. W. Kjellgren, H. Goulden, C. Nelson, W. Logan, and G. Dodson.

On each of the farms visited many little points were seen showing individuality. Generally the spirit of the competitors was one of pride in their holdings and anxiety to reach the stage when their properties are self-supporting. In the latter anxiety one fault must be guarded against, and that is, overstocking. The pastures must be husbanded so that ample feed is available for all stock. Provision must be made for conserving feed as hay or silage. Lucerne is becoming a more popular crop, and, for feeding with the other summer crops, maize, millet, etc., that can be grown, is invaluable.

In conclusion, I wish to record my appreciation of the assistance rendered me by Mr. J. Mayo in the first inspection, and also of the general courtesy shown me by the competitors.

PASTORAL RESEARCH PROBLEMS.

By the Director of Agriculture,

Geo. L. Sutton.

Live Stock Position.

"Australia is essentially a pastoral country," a land of great flocks and herds. In 1925—the latest date for which complete records are available—Australia carried on its farms and on its stations 2,250,361 horses, 13,279,785 cattle, 103,563,218 sheep, 1,128,374 pigs, and it has carried in other years as many as 2,527,149 horses in 1918, 14,441,309 cattle in 1921, 106,421,068 sheep in 1891, 1,169,365 pigs in 1917.

"The position to-day is in striking contrast to the humble commencement, which was made at the birth of the Commonwealth, when Governor Phillip brought with him in 1788, 7 horses, 6 cattle, 23 sheep, 12 pigs, and a few goats. No great stretch of imagination is necessary to realise that innumerable problems were encountered and difficulties overcome before the gap between then and now was bridged. This is emphasised by the fact that in 1790—two years after the infant settlement was established—Governor Phillip reported that no country offered less assistance to the new settler than did this, and that there was then no prospect of feeding the small community under his control —about 1,000 souls—with its agricultural (including pastoral) products. Fortunately, as the result of the development of these natural advantages for pastoral purposes, which this country was found later to possess, the position entirely changed, and not only was the community able to support itself, but in the year referred to, or 137 years later, it produced agricultural and pastoral products far in excess of its own requirements. The wealth produced in the Commonwealth amounted in that year to £454,106,000, and of this the flocks and herds were responsible for £162,423,000, a sum almost equal to that produced by the manufacturing and mining industries combined.

"Naturally, there have always been pastoral problems in Australia. In the early days the very survival of the young colony depended on their solution. To-day the position is hardly less important, for because of the tremendous interests involved, problems connected with the welfare of our flocks and herds, whether carried on farm or stations, are of transcendent importance. In the past the problems which have been solved were solved mainly by the common sense, grit and perseverance of those concerned, but they were also aided in some instances by the research work and discoveries of the scientific worker. The position to-day is that many of the present-day problems—including some of the unsolved ones of the past—can only be solved by him.

Work Being Done.

"The problems which are now being attacked or awaiting attack may be divided into four main groups, viz., those dealing with—(1) Animal nutrition; (2) animal diseases; (3) the suppression of pests; (4) stock breeding

Footnote: This article represents one of a series of lecturettes delivered before the Royal Society and is published in extenso as delivered before the W.A. Branch of the Economic Society of Australia and New Zealand in October last.—(Editor.)

or animal genetics. Already a scheme of research in connection with animal nutrition problems has been undertaken by the Council for Scientific and Industrial Research, and has been placed in charge of Professor T. Brailsford Robertson, of the University of Adelaide, who has been carrying out investigations in connection with one phase of this work for the past few years under the 'Animals Products Research Foundation.' In this field, which is of immense scope, Professor Brailsford Robertson proposes to examine comprehensively Australian pastures to determine their mineral deficiencies, and also their mineral excesses. Associated with this will be the research work to be carried out at the Waite Institute in order to determine the mineral content of Australian fodder plants under natural and artificial conditions. This latter investigation is to be conducted on parallel lines to those carried out in South Africa, New Zealand, Canada, and Britain. Professor T. Brailsford Robertson suggests that there is a very definite iodine deficiency in the pastures of parts of Australia, and he, therefore, proposes to conduct an iodine survey of our pastures. The nitrogenous content of our natural pasture plants is also to be investigated by him so as to ascertain what plants, or group of plants, are best adapted to supplement the protein deficiences of other plants.

"Closely allied with plant nutrition problems are investigations connected with poison plants. In this State work in this direction is being carried out by Mr. H. W. Bennetts, the veterinary pathologist of the Department of Agriculture and research with these plants on other lines is also being undertaken in New South Wales. There the investigations have been divided into three main lines—Chemical, Veterinary, and Pharmacological. The first section is under the control of Professor Kenner, of the Sydney University, and is to be carried out by chemists on the staff of the Council for Scientific and Industrial Research. There will also be collaboration with the chemistry section of the Sydney Technological Museum. In the veterinary section the experimental work is being conducted at the New South Wales Veterinary Research Institute at Glenfield, whilst in the pharmacological section the work is carried out under the control of Professor H. G. Chapman, of the University of Sydney.

"The function of research in connection with animal disease is, as pointed out by Professor M. A. Woodruff, to minimise. and, if possible, eradicate some of the comparatively few diseases found in the Commonwealth, for it is important to keep the stock healthy, as unhealthy stock cannot produce maximum quantities of meat, milk or wool, however well and properly they may be fed. Research work on a comprehensive scale in connection with animal diseases is already proceeding in various parts of the Commonwealth. At the Glenfield Veterinary Research Institute work in connection with the following matters is in progress: (1) Paralysis in pigs—a disease which occurs especially in young pigs when they are being topped off for the bacon factory, and is a matter of great concern to the dairying industry. (2) Toxaemic plethora—a disease which causes high mortality in the best lambs, and of which the cause is quite unknown. (3) Sterility in cows—a matter of very serious concern to dairy farmers, as well as to graziers.

"At the Sydney University Veterinary Department research work is being conducted in connection with (1) Braxy-like disease; (2) Cheesy cysts (Caseous lumphadenitis) in sheep—a disease which is prevalent in Australia,

and which is becoming of serious importance in connection with the export of frozen mutton; and (3) Stomach worms in sheep and other parasitological problems.

"At the Melbourne University Veterinary Research Institute, investigations are in progress on bovine pleuro-pneumonia, bovine tuberculosis, and the Life History of the Beef Nodule Worm.

"In Western Australia investigations are in progress on:—(1) Braxy-like disease—by Mr. W. H. Bennetts, in the Veterinary Laboratory at the Department of Agriculture; and (2) Kimberley Horse Disease—by Professor Ewart and Mr. D. Murnane in the north-west of Western Australia. In connection with this investigation, it is gratifying to learn from a preliminary report issued by Professor Ewart that the investigations connected with this problem are likely to be brought to a satisfactory conclusion at an early date.

"Investigations connected with the control or eradication of pests with the object of reducing and preventing the extension of losses therefrom involve:—The continuation of blowfly investigations; the continuation of the investigations dealing with the eradication of prickly pear; the continuation of investigations dealing with the control of the buffalo fly; the better control of the rabbit pest; the control and eradication of noxious weeds; the control of red mite; and the control of lucerne flea.

"As indicating the necessity for research in connection with the suppression of pests, it may be stated that in a bad year the estimated losses due to the blowfly pest amount to £4,000,000. The devastations of the red mite and the lucerne flea are such as to threaten the wholesale destruction of the leguminous plants in our pastures, and are, therefore, a matter of most serious concern. Investigations in connection with these two pests are being carried out by Mr. L. J. Newman in the field and in the entomological laboratory at the Department of Agriculture, and it is pleasing to record that satisfactory methods of controlling these pests in garden crops have already been found.

Research and the Australian Merino.

"Though there are awaiting solution problems connected with the cross-breeding of cattle for the production of possibly hardier types for special areas, and with the cross-breeding of swine for the production of better types for export bacon, the problems of animal genetics, which are of the greatest importance, are those relating to the production of merino wool. Of any single section of pastoral production the sheep contributes most of the pastoral wealth of Australia. Last season Australian sheep produced 2,610,000 bales of greasy and scoured wool, which, when calculated on a greasy wool basis, contained approximately 850,000,000lb. which realised £58,072,500. The sheep is, in consequence, a symbol of Australian prosperity, and any work connected with its improvement is obviously of special interest. Before suggesting any line of investigation in connection with sheep breeding a tribute must be paid to the stud masters of Australia, who have done so much to increase the wealth obtained from this source. Though both our climate and our pastures are eminently suitable for the growing of merino wool, it is the human element which directs operations which is, therefore, responsible for the production of sheep

which can take advantage of these to the full. Our debt to the stud masters of Australia in consequence is exceedingly great. Because of their efforts the flock masters of the Commonwealth have been enabled to more than double the average production of their sheep in a period of about 60 years. In 1861—the earliest date for which I have been able to obtain details—the average production of greasy wool per sheep (including lambs) was 3.74 lb. per head. Forty years later, at the beginning of the present century, the average production had been raised to 7.06 lbs., or nearly doubled, and in the season 1924-25 the improvement was such that the production per head was 7.69, or more than double that in 1861.

Skill of the Breeders.

As far as can be learnt, the great improvement in wool production, which has taken place, has been brought about by the skill of the breeders following traditional methods, combined with that intuition for recognising and selecting good stock, which is characteristic of many of the British race, who have a liking for and interest themselves in such work. The traditional methods are based upon the principle that 'like begets like, with a continual tendency to variation.' The result has been the vast improvement of the original stock already referred to, and the evolution of the "Australian merino" of several distinct types which have been developed to meet the requirements of differing conditions of climate and feed. The improvement is still going on, but because of the great success already achieved, further improvement is more difficult of attainment. To aid in the performance of this more difficult task there is, however, now available the information resulting from the persistent study of the laws of inheritance by eminent workers during the present century.

The great aim of the stud sheep breeder is to secure animals of uniform excellence and with ability to transmit their desirable qualities to their progeny. This is also the great difficulty. The greatest improvement which has been achieved in this connection is believed to have been secured largely as the result of mass selection within inbred flocks. In view of the information now available regarding the laws of inheritance it is possible that further advancement lies in initial selection within inbred families in order to secure parents which are genetically pure ((homozygous) with regard to particular desirable characteristics) the initial selection necessary to secure these to be followed by the subsequent crossing of related families of the same homozygous type. Before the genetically pure individuals of the type desired can be selected with certainty by the stud master, research is essential to determine the extent of environmental variation so as to ascertain the factors which are purely hereditary, for it is well known that the environment—of which feed and climate are part—also modifies the quality and quantity of wool produced. With this information available, the breeder will be enabled to determine which of his animals are genetically pure and which in consequence can be relied upon to transmit the factors which they possess to their progeny. The importance of ensuring that the parents are pure regarding the desirable factors is illustrated by what has been discovered in connection with the inheritance of wool colour in sheep. It has been found that the production of white or black wool is due to the presence of inherited factors, viz., the colours black and white, of which white is dominant over black. For a black woolled sheep to appear

it is necessary for the animal to be pure for the black factor. On the other hand a sheep carrying white wool may be either pure for the white factor, or it may also carry a latent factor for black. In consequence if but one genetically impure heterozygous white sheep ram or ewe, carrying the factor for black in its germ cells, be introduced into a pure white flock, it is possible by selection within that flock, to develop a pure black flock from it. Research is also necessary to ascertain the extent to which blending and linking of the factors which are hereditary take place.

It is important to stress the necessity for research in the direction indicated for remarkably little is on record regarding the factors which are inherited and connected with the production of wool and its quality.

Laws of Inheritance.

The laws that govern inheritance have been found to be much the same in the plant as in the animal world, and as there are certain points of similarity between the process of reproduction, and in the methods adopted for the prevention of deterioration in maize and in animals, it is of interest to refer to the results of the work of Professor G. R. Shull in connection with the genetics of the maize plant. The maize plant, though hermaphroditous, is usually and preferably fertilised by the pollen from another plant. To obtain seed for the succeeding crop the ears are "culled," *i.e.*, only the best specimens are retained, as with sheep in the breeding flock. It was found that seed from these choicest ears could not be relied upon to reproduce their excellence either as regards quality or yield. In order to study the cause of this, Professor Shull commenced his research work. He found the seed so culled was not genetically pure (homozygous). The strains were not pure, and consequently did not breed true to type. Because the seed bearing plants were pollinated from other plants of the same so-called variety or strain, and neither was genetically pure, though of the same type, the effect was similar, but in a lesser degree to that of crossing, and the lack of uniformity was accounted for. The fact that a crossbred plant or animal may be as fine or even finer looking than a pure bred and that it is not prepotent because it does not carry its factors in the duplex condition in its germ cells was emphasised. Professor Shull set to work to correct this lack of uniformity, and to secure pure strains or homozygous plants by inbreeding. He inbred and inbred until the resulting plants and cobs were nothing but low yielding runts, but they had uniformity. He then crossed two families of these inbred runts, and at one bound the resulting seed showed in addition to uniformity, remarkable vigour, and produced a crop of 77 bushels to the acre, four times the average yield of their inbred runty parents. As the result of mating some of the families which "nicked" well the yield of 98 bushels per acre was obtained, or 20 per cent. greater than the original parents which have never been inbred at all, so that both prolificacy and uniformity as well as conformity had been secured.

Experiments with Wool.

At the Animal Breeding Research Department, University of Edinburgh, research has been conducted regarding the inheritance of various types of wool. Much useful information was obtained in a short time, not the least of which was that the presence of both "kemp" and "black hair" is inherited and amenable to selection. In view of the most im-

portant part which wool plays in connection with the production of our national wealth, a special plea is made that there be provided, somewhere in Australia, facilities to conduct similar work by similar means (research) in connection with our great merino flocks. It is believed that research in connection with animal genetics will indicate the speediest and readiest means by which the average production of our sheep can be permanently increased.

Research in connection with animal genetics is team work. It will mean at least a dual and possibly a triple alliance. The knowledge and skill in management only acquired by practical experience with, and close observation of sheep or other animals and their peculiarities, is as essential as academic training. The active and close co-operation of the practical pastoralist with the trained scientific worker in applied agriculture is therefore necessary, and they in their turn may need to call in, as a consultant, the worker in pure genetics.

Some realisation of the great value which research is likely to be to the pastoral industry on farm and station may be obtained from the successful results already obtained in connection with animal diseases. I am indebted to Mr. H. W. Bennets, veterinary pathologist to the Department of Agriculture, for the following instances:—

Beneficent results due to diagnosis of contagious diseases and consequent segregation or disposal of carriers of infection, by means of laboratory and other methods, *e.g.,* (1) diagnosis of tuberculosis by tuberculin test; (2) diagnosis of carriers of contagious bovine abortion by means of agglutination test (a "blood test").

The prevention of disease by means of biological products of disease—*e.g.*, (1) Anthrax—sheep, cattle, and horses may be immunised by means of vaccines and run on anthrax infected pastures without loss. (2) Tick fever in cattle—cattle made tolerant of infection by previous treatment with infective blood. (Bulls have been so treated prior to shipment to the North-West.) (3) Swine fever, rinderpest, blackleg, etc.

The prevention of parasitic infestation as the result of elucidation of life histories of animal parasites, and attacking any weak links in the chain, *e.g.,* (a) by drainage and running susceptible animals on high dry parts of pastures, and (b) by using "trough" water for stomach worms and lung worms.

By treatment—either with drugs or biological products—*e.g.,* (1) sheep scab (mange) has been eradicated from Australia by means of dipping, (2) tick and lice controlled by dipping, (3) trypanosomiasis—various conditions due to blood parasites, as "Surra" can be treated with complex drugs, such as "Bayer 205." (4) Stomach worm infestations in sheep and cattle can be more or less satisfactorily treated with copper sulphate given as a drench. With periodical treatments sheep particularly can be reared on heavily infested country which otherwise would not be possible economically.

Fruits of Research.

Sometimes the fruits of research are gathered quickly as was the case with a recent investigation carried out by Professor Ewart in connection with the cause of the losses of the cattle on a section of an important stock

route between Wycliffe Wells and Taylor Crossing in the Northern Territory, and known as the poison zone. Thousands of cattle pass along this route every year, and in 1923 an average of 20 animals out of every 100 died of some kind of poisoning on that road. It was arranged that Professor A. J. Ewart, of the Melbourne University, should investigate the cause of the trouble. Almost at once Professor Ewart placed two plants under suspicion—one a sage bush (*Isotropis atropurpurea*), and the other an indigo plant (*Indigofera boviperda*). The suspicions proved well founded, and in 1925 steps were taken to clear a strip of this poison some 150 yards wide and about 40 miles long. This was done with the aid of native labour at a cost of £150. In 1926 a mob of 3,000 cattle passed through this one time poison zone without a single casualty.

At other times results are obtained only with great difficulty, and after prolonged search, as appears likely to be the case in connection with the Buffalo Fly investigations. Sometimes results are not obtained in the direction desired. A research worker is not like a manufacturer; he cannot begin on a problem and say that he will finish it, or even reach a certain stage in a given time. He has to apply all the knowledge he possesses and the best technique of which he is capable, and then carry on in the hope that he will succeed. To encourage him to look forward with hope he can look back upon the success other workers have achieved in the same or in a similar domain. Whilst this is being done those who are concerned in his work must be asked to be patient.

ROOT-ROT AND FOOT-ROT OF WHEAT.

(*Wojnowicia graminis and Helminthosporium sativum.*)

W. M. Carne,

Economic Botanist and Plant Pathologist.

There are several diseases of wheat in Australia characterised by the rotting of the roots and bases of the stems. Of these the best known to growers is Take-all, the name applied to the disease caused by the fungus *Ophiobolus graminis*. This article is intended to draw attention to two diseases somewhat resembling Take-all, and often confused with it. One of these is due to *Helminthosporium sativum,* which causes the condition known as Foot-rot, and the other to *Wojnowicia graminis,* which also causes a foot-rot, but for which the term Root-rot is suggested. It must be understood at once that all three fungi cause a root or foot-rot disease, and the terms used are simply for convenient distinction.

Though the casual fungi are themselves quite distinct, the same cannot always be said for the symptoms of wheat plants affected by them. The following distinctions hold good in normal cases, though it must be admitted that a laboratory examination is sometimes necessary for positive identification.

Take-all (Cause = *Ophiobolus graminis*).—Attacks usually in more or less rounded patches of varying size. May kill seedlings or half-grown plants, or cause "whiteheads," that is, prematurely ripe heads without grain. The stem bases show a black discoloration, extending above the ground level and covering a length of stem upwards of two inches. This discoloration is partially superficial, and a black felt of fungal growth can be scraped off the stem or the inner surfaces of the leaf bases surrounding it.

Root-rot (Cause = *Wojnowicia graminis*).—Though this parasite may attack wheat in patches, these patches are more irregular than in Take-all, sometimes appearing as strips. In more typical cases affected plants are scattered through the crop, and this also occurs even when some of the affected plants are in patches. Both Root-rot and Take-all may occur together, which makes field identification more difficult. Though plants may be killed as seedlings or before heading, Root-rot is usually not noticed until "whiteheads" begin to show up in a crop. If grain is formed, it is usually shrivelled. The stem discoloration is less marked than in Take-all, and rarely extends above ground. It varies from dark brown to black in colour and is partially superficial, so that it may be mistaken for Take-all. The discoloration is, however, usually in spots and streaks rather than generally distributed over the surface as in the latter disease.

Wheat affected by Root Rot, showing effects on roots and stem bases.

Foot-rot (Cause = *Helminthosporium sativum*).—This disease is similar to Root-rot in its field occurrence, and usually is first noticed when "whiteheads" appear in the crop. The stem discoloration takes the form of dark brown streaks, spots or patches. There is no superficial black fungal growth, and the affected parts of the stems do not extend above ground. Grain, if formed, is usually shrivelled.

Foot Rot of Wheat, showing stages of development in infected plants.

Of the three diseases Take-all and Root-rot are about equally common in this State. Foot-rot is relatively rare. During the recent season (1927) Root-rot was apparently more common than Take-all. Many crops in the eastern, central, and southern areas, which promised well up to the end of September, then showed evidence of disease in the form of "whiteheads."

In some cases losses of 30 to 50 per cent., and occasionally even more, of the estimated yield were experienced. Ten per cent. losses were not uncommon, while other affected crops were cut for hay.

Assuming Take-all, Root-rot, or Foot-rot to be present in crops, the amount of damage done is determined by the climatic conditions. For serious loss there must be the combination of one or more of these fungi, sufficient soil moisture and a suitable soil temperature while the crops are still green. Experiments at Wisconsin, U.S.A., have shown that infection by Take-all is greatest at soil temperatures of 54 deg. to 64 deg. Fah., while with Foot-rot maximum infection takes place at 80 deg. to 90 deg. Fah. Concerning Root-rot no experimental data is known to the writer, but its occurrence at the same time as Take-all, and not infrequently on the same plants, indicates that its temperature requirements must approximate to those of Take-all.

Accepting the foregoing we can see that Foot-rot damage is liable to occur seriously on crops (where the disease is present) only when the temperatures are high and the ground moist. Such conditions might occur with April rains in early-sown crops or with hot spells in the spring and early summer. In the latter case there may be insufficient moisture for the fungus to thrive.

Take-all and Root-rot on the other hand require a medium soil temperature. They may therefore be expected about June before the soil gets too cold or in the spring. The longer the period of medium soil temperatures the more likely are these fungi to spread and cause serious damage. The 1927 season, following the warm dry spell, which concluded on 12th September, was notable for the continued humid weather, dull skies and showers, and an absence of dry easterly winds until about the middle of November. The temperatures were moderate, and the consequent widespread appearance of Take-all and Root-rot when the plants headed was in accordance with expectations. Along the Eastern Goldfields line and southward these diseases were in evidence, and especially in the southern and eastern portions of the Great Southern line. There the temperatures were particularly mild and favourable for infection.

It is noteworthy that the humid conditions of the season caused the appearance of rust throughout the wheat belt, though without causing serious loss, except in individual crops in the Midland areas. Take-all and Root-rot were not reported from the northern areas, the higher temperatures, though favourable for rust, apparently operating against root diseases. A somewhat similar distribution of these diseases occurred in 1926, which was also a season of late rains.

The conclusion to be arrived at from the foregoing is that late rains in the spring and early summer, combined with cloudy, humid weather, are liable to lead to rust more particularly in the northern areas and to root-rotting diseases in the central and southern wheat areas. Humidity must not be judged on a basis of rainfall. Heavy rain storms followed by bright warm weather and easterly winds are less favourable to these diseases than cloudy showery weather with westerly winds, though the actual seasonal rainfall may not be above normal.

Infection in Foot-rot and Root-rot takes place from the soil. The soil itself becomes infected through the presence of infected plants, or through the infected stubble of wheat or susceptible grasses being blown or carried on to the paddocks from infected stubble land or headlands. Barley, Barley Grass (*Hordeum murinum*), and the so-called Spear Grasses (*Bromus spp.*) are liable to these diseases. Oats are not known to be attacked, and the same applies to field peas and other crops not belonging to the Grass family. Root-rot infection is not carried by the seed. *Helminthosporium* may sometimes attack the seed, causing a discoloration at the germ end, called "blackpoint." Such a discolored sample of grain should not be used for seed. Blackpoint is not, however, positive evidence of Foot-rot, as other fungi may cause similar discoloration.

Control Measures on infected land.—These measures are identical with those advocated for Take-all. It must be realised that control is all that is practically possible. Eradication cannot be expected. By following the practices advocated the diseases will be reduced to a point where they do a minimum of damage, though it must be admitted that that minimum may be appreciable in years favourable for infection. It is not expected that all farmers will be able to carry out the recommendations as thoroughly as one would like. They are recommended as ideals at which the farmer should aim as far as his time, farm equipment and other circumstances will allow. At the same time, in so far as they are not carried out, the best results cannot be expected, nor should they be criticised on the results obtained when followed only in part.

1. *A good, clean, stubble burn in badly-affected paddocks.*—The object of this is to destroy as much as possible of the lower parts of the infected stems. These are the parts which carry the fungus. The latter does not die with the plants, but lives in spore (fungus seed) form in the dead wheat tissues. If not burnt the infected parts of the stubble will be blown about the paddock and into other paddocks, especially if broken up by the trampling of sheep. The headlands should also be burnt, as some of the common grasses carry diseases.

2. *Early and clean fallowing before sowing wheat.*—Unfortunately a stubble burn does not destroy all the affected stem bases or roots, and cannot be relied upon to effectively control these diseases. It is therefore necessary to plough the infected areas early so that the spores are turned into the moist soil. This will not cause them to rot, but will induce many to germinate. Once they have germinated they must find something to attack or die. Hence the necessity for clean fallows. If ploughed in July it is probable that in August or September the fallows, if not cultivated, will be green. This green growth will certainly include Barley Grass and Spear Grass. These grasses are subject to the diseases, and will be attacked by the spores already ploughed in. On them the fungi will revive and proceed to the production of more spores, destroying to a large extent the value of the stubble burning and early ploughing. Therefore the stubbles should be kept clean in the spring. From July to November in a cool, moist spring, or to October in more normal year it is dangerous for grasses to grow on infected fallows. After that, from a disease point of view, it matters little what growth occurs. At high temperatures, either or both the fungi and the susceptible grasses will not grow.

3. *Rotation with oats* for grazing, hay or grain will give another season for the spores in the soil to germinate and die. Oats are not affected by Root-rot or Foot-rot.

4. *Sowing wheat after the first rains*, when the season allows, gives such fungus spores as still remain in the soil a further chance to germinate and die before the wheat germinates.

When all the above practices have been carried out to the best of the farmers ability, he must not forget that Barley Grass and Spear Grass along the headlands and in adjoining paddocks left in grass are potential sources of infection to clean paddocks if growing on infected soil. To let an infected area go to grass does not check the disease on that area. Rather it is liable to infect adjoining areas through infected fragments of the grasses being blown or carried to them.

Summary.—Root-rot and Foot-rot are diseases of wheat resembling Take-all.

They can generally be distinguished from Take-all by not occurring in rounded patches, and are usually first detected through the appearance of "whiteheads" in the crops.

Root-rot is probably as common as Take-all in this State. Foot-rot is relatively uncommon. Though found in all seasons their serious occurrence is closely dependent on weather conditions.

The methods recommended for the control of Root-rot and Foot-rot are those which have proved successful with Take-all. Their most essential features are early and clean fallowing, and rotation with oats.

BEE NOTES.

H. Willoughby Lance,

Apiculturist.

Work for the ensuing Three Months.

This must necessarily vary in different districts according to their seasons. Some districts will be harvesting their surplus honey, and others not until later. Swarming should not trouble anyone. Those who have secured a surplus should see that the honey is carefully strained and stored in tanks or tins. A word here with reference to cleanliness would not be out of place. Some extracting houses and store rooms are models of cleanliness, while many others are far from what they should be, and some of the honey far from clean. All bee-keepers, especially where the honey is for sale, should see that the extracting is done in a clean room, if they have not properly built honey houses; and that all utensils and tins are perfectly clean and kept free from dirt and dust. Any vessels containing honey should always be kept covered.

If no surplus has been secured, then be on the look-out for the signs of a honey flow, and should such occur be sure that there are plenty of empty storage combs in the hives.

It is always advisable, as far as possible, to keep the honey from different flows separate, otherwise a heavy flow from a good source may easily be spoiled by a small one from another with a strong or objectionable flavour, when, instead of having a large quantity of first-class and a small quantity of second or third grade, it may all become only second-class.

Bees and the Orchard.

Orchardists do not always recognise the importance of the bee-keeping industry in relation to their own.

It has, however, been proved over and over again that to have bees in or near an orchard at flowering time means more and better fruit. In America this is realised to such an extent that some orchardists who will not trouble to keep bees, and have none in the neighbourhood, will contract with a bee-keeper to place a number of hives in their orchard at flowering time to ensure good pollination.

Experiments conducted by the University of California proved conclusively the value of the honey bee for the pollination of fruit trees. The experiments were made on prune trees entirely enclosed under mosquito netting, so as to exclude or enclose pollen-carrying insects as desired.

Without going into full details of the experiments, which covered a large field, the following facts from the experiment on the French Prune will prove of interest to fruit growers.

A French Prune tree was enclosed, and all pollen-carrying insects excluded therefrom. A similar tree was enclosed, and a hive of bees placed therein for six days while the tree was blossoming.

The setting of fruit of these trees was compared with that of the orchard generally, the method being to count and mark about a thousand blossoms on each tree, then later to count the matured fruit, with the following results.—

	1916.	1917.
Set of tree from which bees were excluded ..	1.04	0.43
Average set of orchard, unenclosed	3.59	13.2
Set of tree with bees enclosed	18.05	19.00

The difference between the average set for 1916 and that of 1917 was accounted for by the fact that in 1917 a number of colonies of bees had been placed in the orchard.

The following is an extract from the summary of results:—"The work of the year just passed again shows the value of bees as pollen-carrying agents. Reports from a number of growers who kept bees in their orchards during the blossoming season agree with the results obtained experimentally on the Sorosis Ranch. In every case a substantial increase was reported."

At the Sorosis Ranch the increase on the French prune trees, due to the use of bees, was remarkable. The insects are at least largely responsible for the increase from 3.6 per cent. in 1916 to 13.2 per cent. in 1917, when there were 115 colonies of bees in a 180-acre orchard.

Even more striking results were obtained from the trees which were under the tents. Here the bees and similar insects were excluded and confined, and in the latter case forced to work several days on only the blossoms of the tree under experiment. The trees from which the bees were excluded, though given the same cultural treatment as the check trees, failed to set even a fair crop. The data points to the necessity of some agency for distributing pollen, and shows the beneficial results from the use of such an agency.

Although the marked increase obtained in the experiment could not be obtained in a commercial orchard, because of the impossibility of confining bees to a certain section, still a noticeable benefit should result from the keeping of bees in conjunction with a prune orchard."

In addition to being so necessary to the orchardist to ensure a good crop of fruit, he should also obtain a surplus of honey for his own consumption, at no cost beyond the capital outlay for the bees and hives, and what better food can be given his children than nature's sweet. If also there is suitable bee flora in the surrounding country he will be able to obtain more than sufficient for his own needs, and the honey harvest will mean a welcome addition to his income.

Bee Hives and the Control of Disease.

Bees should never be kept in plain boxes for longer than is necessary to prepare a proper frame hive, otherwise they will build the combs to the top and sides, and it will be impossible to examine and control the bees or remove the surplus honey without destroying many bees and losing much honey. Frame hives are so-called because they are fitted with movable frames on which the bees can build their combs for storing the honey, and these can be lifted out so that the honey may be extracted, or examined for any purpose, particularly to see if disease is present.

It must be borne in mind that bees are liable to disease, the same as any other stock, and neglect may not only mean the loss to the bee-keeper, but the spreading of the disease to, and the destruction of, all the bees in a district. It is, therefore, obviously desirable that the hives be fitted with movable frames, so that the comb may be readily examined, and, at the first sign of disease, steps taken to control it.

The most common form of disease is one that attacks the brood in the sealed or unsealed condition, therefore any difference in the usual appearance of the comb, and particularly the brood should be carefully noted, and if advice is desired a request for same, with as many details as possible, should be sent to the Department of Agriculture.

The Wax Moth is not actually a disease, but a pest which destroys the combs, and sometimes drives the bees out. Prevention is better than cure. This consists of keeping the colonies strong in bees, as the moth pest is seldom troublesome in strong hives. Some races and strains of bees are better fighters, and more able to resist moth and disease than others.

The Black or German Bee, although very often a great fighter against its human master, does not appear to resist moth or disease in the same way as the Italian, therefore the best bee to keep is the Italian.

Hives.—If a bee-keeper cannot afford to purchase all his hives from a manufacturer, and intends making his own, it is advisable first to purchase a standard hive from some reputable manufacturer as a pattern. Bees are very exact insects, and standard hives are based on careful study for many generations of the habits of bees. Do not think that any box that will hold frames will do. The best is not too good for the industrious little worker that fulfills such a useful part in the great economy of nature, in which the Great Creator of all provided that none should live unto himself, but has made us all dependent on some other section of His creation.

Frames.—These can be bought so cheaply that it does not usually pay to make them for oneself. It is difficult to get suitable wood, strong, and not liable to crack or warp. Further, the bought ones are all made exactly alike by up-to-date machinery. Frames should always be well wired, several different methods being adopted by various bee-keepers, according to fancy, but the one with four horizontal wires is that in most general use. Foundation comb should always be used, and full sheets by preference; this ensures straight combs and worker cells. When foundation comb starters only are used the bees usually build a large number of drone cells, and often the combs are not straight from the centre of the frame.

PIG-RAISING.

THE BOAR AND THE SOW.

P. G. Hampshire,

Superintendent of Dairying.

The Herd Boar—Selection and Management.

The first and most important consideration in the selection of a herd boar is purity and type. With the boar these two factors are of the utmost importance. The herd boar may be responsible for from 1,000 to 1,500 progeny during his life—the sow 100. Pure bred boars can be easily obtained at reasonable prices—breeders desex hundreds every year. As a dairy sire is selected according to his purity and production ancestry and proved by the milk production of his progeny, so the boar is selected on purity, type and prolificacy of his parents, and judged by the size of his litters and their marketing qualities. Purity, if constitution is sound, means prepotency. Pure breds stamp their progeny because of a concentration of one blood.

"Cobber," No. 3048. A Berkshire Boar bred by Henry Gillam, Guildford. A.R.A. Show winner, beating imported pigs.

Registration in the Herd Book is the guarantee of purity.

Pedigrees are only worth the paper they are written on when they are not registered. No matter what pure breed the boar is, certain essential points are necessary to breed shapely, quick-growing, marketable porkers and baconers. The animal should have distinctive masculine virile characteristics which will be indicated by his general appearance and move-

ment. His head should be strong, having powerful jaws, open nostrils, good width between the eyes and ears, strong muscular neck, shoulders shapely, sloping and free from coarseness, level and not open on top—good width through heart—well sprung ribs, strong, straight or slightly arched back of good length, but without any indication of weakness at coupling and over loins, deep sides—especially at flank—square broad rump, hams wide and deep to the hocks (this is the most valuable part of the pig), and especially, too, must his legs be strong, straight, and squarely placed with good feet and pasterns—remembering that weak, crooked legs mean bad walkers and *weak servers*. (It will be realised that faulty legs are a serious defect in driving pigs to market). A mellow smooth skin, free from deep creases and covered with fine, straight hair, is required. We are accustomed to curves with a pig, but don't forget straight back, legs, and hair. A successful boar should sire big litters, and this desirable feature will more likely be obtained if he himself is one of a big litter. The various degrees of prolificacy in boars is remarkable. The writer has seen instances of one boar averaging 6, 7, or 8 pigs per litter from a herd of brood sows, and with the introduction of another boar the average increased to 9, 10, and 12 pigs per litter per sow, and in almost every case the boar responsible for the markedly increased litters was one of a big litter himself, and his family were noted for their prolificacy.

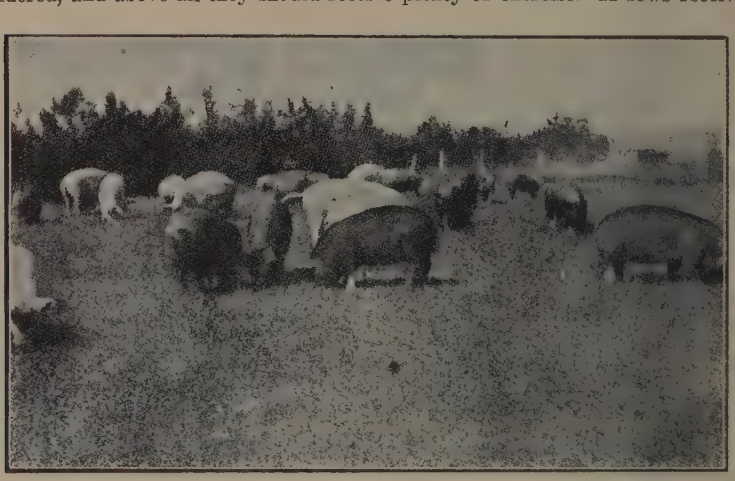
If a boar is selected as a weaner he should be fed intelligently with muscle, bone, nerve-tissue-forming foods, or *protein*, his normal growth not checked, and given plenty of exercise. At four months it is advisable to separate him some distance from sows. He should not be used for stud purposes until 8 or 9 months old, and then only sparingly at long intervals—the first season 8 to 10 sows should be the limit, after that up to 40 or 50 sows may be served in the season if he is used judiciously. The boar should be properly penned with ample room for exercise and provided with shade, shelter, and plenty of clean water. While developing and in service he should be well fed with nitrogenous foods with a reasonable amount of green stuff such as lucerne, peas, vetches and clovers, these being particularly good. When out of service the ration should be considerably reduced, but the animal should not be allowed to fall away. It is advisable in hot weather, or if sluggish, to put sows to the boar early in the morning before feeding. If firmly and not harshly treated, viciousness may often be avoided, but in any case it is advisable to cut a boar's tusks—it's a safe policy. On no account should the boar be allowed to run with sows as it is wasteful, and no record can be kept of farrowing dates. As can be done where there a few small farmers reasonably close together in regard to obtaining a good dairy bull for community use, so a good boar pig can be procured for suitable service with sows. Do not fail to treat a good boar well (a bad boar should not be kept), as he is the gentleman who will have most to do with paying the rent.

The Brood Sow—Selection and Management.

In selecting a suitable breeding sow for *stud* purposes the first essential is purity, of which registration in the Herd Book is the guarantee. It must conform to breed type. Even though the sow required is *not for stud* purposes, its function is to breed young pigs to be slaughtered as porkers or baconers, and to be satisfactory in this respect should have certain

points:—strong jaws, open nostrils, good width between eyes and ears, sloping shoulders (not coarse or open on top), strong, straight or slightly arched back, freedom from weakness at loins, long barrel, deep sides, well sprung ribs, square rump, good hams, sturdy straight legs squarely set on, good feet, smooth mellow hide well covered with soft straight hair, 12 to 14 well placed, properly formed teats. Summed up the essentials are:—freedom from coarseness, strength of back and loins, length and depth of sides, good hams, legs and feet, ample evidence of udder development, with not less than 10 teats.

When procuring young maiden sows (yelts or gilts) full development can only be estimated, but the first consideration should be that they are from big litters, are good healthy doers, not runts or defectives. The yelt should be fed with nitrogenous food (rich in protein) to build up nerve tissue, muscle, and bone, but not fattened. They should receive plenty of exercise—grazing in clover or lucerne pasture is of immense value to growing breeding cows. At from 9 to 12 months, according to development, the yelts should be put to the boar. It is a mistake to breed too young, as it will impair the number of future litters, and if left too late they will become too fat, may be difficult to breed, and often prove barren. When pregnant a sow should feed on foods rich in protein (muscle and bone builder), especially young sows, as the growth of the prospective litter is to be considered, and above all they should receive plenty of exercise. If sows receive



Breeding Sows in pasture.

food deficient in protein they are more likely to eat their young. Clovers, lucerne pasture, peas and vetches in pasture are of great benefit, as they are rich in protein and mean exercise and healthy sanitary surroundings. Fattening foods should not be fed, as it is not desirable to have the sow too fat prior to farrowing. The gestation period is 112 days. Two litters per year are possible, but the writer would advise three every two years—two litters per year are too great a strain. The wild pig breeds but once every two years. Two weeks prior to farrowing the sow should be brought into farrowing pen and protein ration increased—the feed to be easily

digestible, such as kitchen slops, skim milk, pollard, etc. Avoid constipation by dosing with castor oil or three or four ounces of Epsom salts or soap suds. The farrowing pen should have a rail eight inches from the ground floor corners for young pigs to escape being rolled on. Limit bedding with clumsy sows. The young sow should be closely watched at farrowing, after-birth cleared, and blood cleaned up, as a taste of blood will often mean that she will eat the young pigs. Sows that develop this habit should be fattened and slaughtered. For the first 12 hours after farrowing the sow should not receive any food, then light soft feed for a few days, and gradually increased for the first week. Avoid giving her cold water. Unthrifty runts should be destroyed at from 7 to 10 days, and sow well fed from then until her litter is weaned with foods easily digested and rich in protein, such as skim milk, pollard, and crushed or soaked wheat. If the sow is wasting away, it shows that she is not sufficiently fed. If the litter is gaining 5 lbs. per day in weight and the sow is losing 2 lbs. per day in weight, the actual gain is only 3 lbs. When the young pigs are three weeks old they should be induced to feed by providing a trough for them with a pig creep for them to slip through, thus blocking off the sow. Scattered soaked grain is a good plan to induce feeding and searching, and thus provides exercise—a very important factor as regards young weanlings. Feed sow three times daily. Provide plenty of clean water, shade, shelter, and exercise. At four to five weeks old the young males, if not required for breeding purposes, should be castrated. If this is done early there will be little trouble, and they will not be checked in their development. Litters should be weaned at from 7 to 10 weeks, according to their thrift—taking away the biggest ones first and so on. The weaners will now be able to fend for themselves. It is a good practice to flush the sow out with soap suds immediately the young pigs are weaned, as it fits her better for further breeding, and induces large litters. Mix soap suds with sloppy food. The "breeders" will be selected from the litter and the balance will be fattened, the aim being to push them along quickly and avoid a check in their growth. "Breeders" will be fed muscle-building foods rather than fattening foods, and given plenty of exercise.

Tamworth Sows are prolific mothers.

CRIMSON CLOVER

(*Trifolium incarnatum*, Linn.).

W. M. Carne, C. A. Gardner (Dept. of Agric.), and A. B. Adams (Muresk Agric. Coll.)

This annual clover at one time was much grown in this State, but has been replaced to a great extent by Subterranean Clover. It is, however, quite a useful clover to grow for grazing or hay in the South-West, and will succeed on many soils. It does not establish and maintain itself permanently by self seeding.

Since the seed is cheap it would probably be profitable to sow the clover with a cereal crop or rape, since it would not injure the cereal crop and would give better grazing in the stubble, improving the soil at the same time. If sown with oats it can be fed down until it is time to let the oats grow to hay, by which time the clover will be growing thickly among the oats, and will increase the yield and palatability of the hay. If sown with rape, the rape provides the early feed and the clover the later feed, and if spring pasturage is plentiful the paddock can be closed and the clover cut for hay.

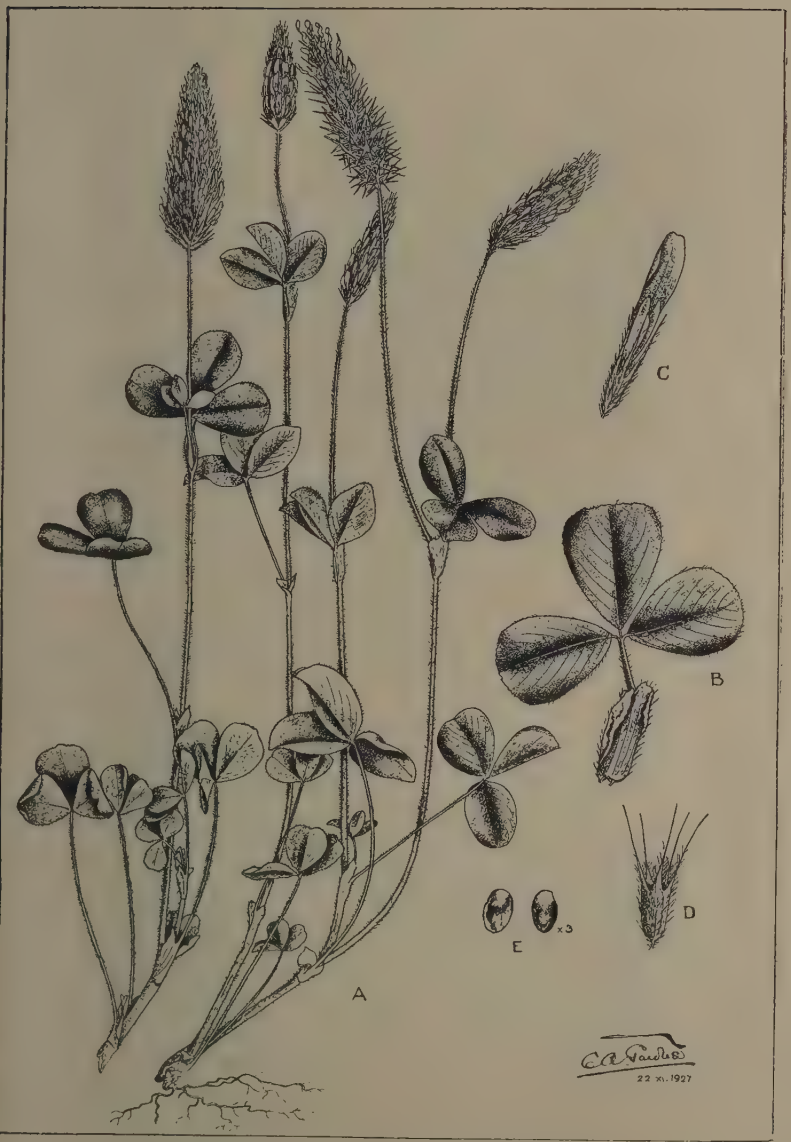
Grown by itself Crimson Clover has the disadvantage of not providing much feed during the winter. It must be cut for hay when in full flower, since if left to run to seed it becomes dry and fibrous and may cause impaction in stock.

Like the other clovers, Crimson Clover responds well to phosphatic fertilisers.

Description of Plant.

A softly hairy annual plant, erect, sometimes under suitable conditions becoming perennial, slender and with a starved appearance when wild, with egg-shaped or oblong terminal flower-heads; but in rich soils, or when cultivated, attaining 1½ to 2 feet in height, with oblong or cylindrical flower-heads sometimes 2 inches long. Stipules broad and membranous. Leaflets broadly obovate or heart-shaped, softly hairy, not conspicuously nerved. Flowers rich crimson, rarely cream-coloured, calyx softly hairy with narrow pointed teeth nearly equal in length. Corolla up to ½ inch long. Seeds fairly large, 1.5 to 2.5 mm. long, regular, roughly elliptical in shape, compressed, the surface smooth, light yellow when new, becoming brown when old.

Native to Southern Europe, the plant has become naturalised in many countries.



Crimson Clover. (*Trifolium incarnatum*, Linn.)

A. Portion of plant. B. Leaf. C. Flower. D. Fruiting calyx. E. Seeds.

FRUIT FLY.

L. J. Newman,
Entomologist.

The attention of all fruit growers is directed to the fact that the dreaded and destructive Fruit Fly is again becoming active.

With the ripening of the early stone fruits, and the increase in temperature, we have the factors necessary for the propagation of this pest.

This pest is carried over from season to season, during the period when there is no summer fruit on the trees, by means of flies which have harboured in the citrus fruits until the stone fruits are sufficiently ripe. These are known as "Carry over" flies. They are stirred into activity on the advent of warm weather, and the presence of ripening fruit on the trees; then egg laying takes place. The eggs hatch in two to four days, and thus the fruit becomes infested with maggots. To prevent its increase it is imperative that all concerned do their part.

Trouble with Fruit Fly is, in the main, caused by the neglect of many growers of fruit to systematically and regularly carry out the work of baiting, trapping, and orchard sanitation. This latter implies that all infested fruit shall, each day, be picked from trees and ground and destroyed by boiling. The fruit after it is boiled may be fed to poultry or other animals.

The destruction of the infested fruit daily by all concerned would, in itself, deal a most effective blow to this worst of all fruit pests.

If infested fruit is allowed to remain on the ground for many hours the maggots leave same and enter the soil. Here they pupate, finally issuing in 12 to 14 days as flies to carry on the work of destruction. Later the fallen fruit may be picked up, but it is then of little use so doing, as the maggots have left same; hence the departmental requirements that all infested fruits shall be gathered daily from trees and ground and destroyed by boiling.

In addition to destroying infested fruit, all fruit trees in bearing must be baited once every seven days with an approved bait. There is confusion in the minds of some growers as to what baiting means. Baiting consists of the application of a "lure" to parts of the foliage. It does not mean the application of the lure to all parts of the tree, as would be done when applying a general spray. The bait is applied here and there in small quantities to the foliage, avoiding the fruit.

The foliage bait can be purchased in "ready to use" form.

Trapping is adjunct to baiting, and refers to the use of a lure suspended in open tins or patent traps. It does not, however, take the place of the foliage baiting.

For use as a "trapping" lure in marginal "lever-lid" tins the following formula is very effective: Pollard 8 ozs., Powdered Borax 8 ozs., Water 1 gallon.

The directions for making this lure are: Mix together with the water and allow to steep for 8 to 10 hours. At the end of this period shake or stir well and allow to settle. The resultant liquid will be fairly clear and amber-coloured. Draw off the liquid, throwing away the residue.

It should be used in the following manner: Three-quarters fill each trap, which should not exceed half a pint capacity, and hang in shady parts of tree, on the north-east and north-west sides.

Renew the lure every seven days. When throwing out the spent lure, it is as well to tip the contents of trap into a tin containing a little kerosene oil. This will kill any flies that may still be living. These living flies, if thrown on to the ground, will in many instances revive.

If desired, a quarter of an ounce of Arsenite of Soda may be added to each gallon of trapping lure. This will act as a poison to any flies partaking of the lure and escaping from the trap.

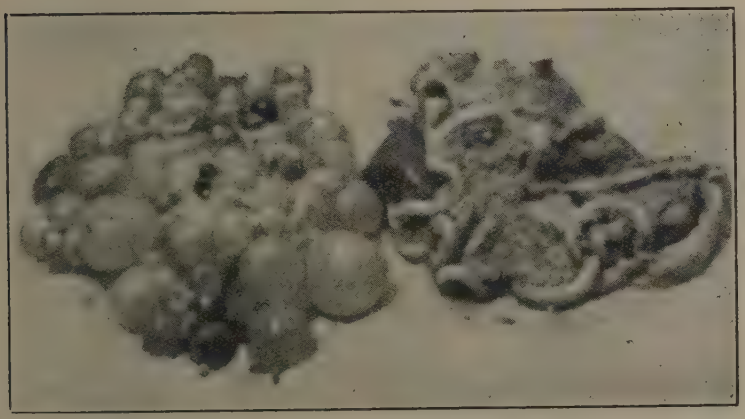
It is well for all growers of fruit to realise that a vigorous campaign against Fruit Fly is being continued by the Department of Agriculture.

Under the Plant Diseases Act, any person who fails to comply with the instructions to bait and destroy the infested fruits is liable to prosecution.

In the general interests of the community, the Department appeals to all growers, large or small, to assist in this effort of control. If all do their part, then the pest can be held in subjection. One neglectful person in a neighbourhood can stultify the efforts of his neighbours. For Bulletin and further information apply L. J. Newman, Department of Agriculture, Perth.

POULTRY DISEASES.

By T. W. Richardson, Poultry Adviser.



Cystic Ovary (left) and carcinomata (cancer) in intestines and mesentery of Black Orpington hen, the latter shown as numerous nodules. The liver (centre of photo.) is also affected with carcinoma. Peritonitis is present.

PERTINENT TOPICS.

Geo. L. Sutton,
Director of Agriculture.

"WHITEHEADS" AND OTHER "TAKE-ALL" LIKE DISEASES.

A considerable amount of concern has been felt by some farmers, particularly in the Southern parts of the Wheat Belt, because crops which gave promise of high yields of 8, 9 and 10 bags to the acre, were found on examination when approaching maturity to have the yield very considerably reduced owing to many of the plants producing "whiteheads," or heads with empty glumes, instead of the normal well-filled grain-laden ears. In some instances the yield was so reduced as to necessitate the crops being cut for hay in order to secure the maximum return. Much of the alarm experienced has been the result of a belief that the cause is some mysterious or obscure disease which is likely to occur each year and cannot be controlled, and therefore threatens for all time the stability of wheat-growing in their district, and as a corollary the financial position of the farmers. This alarm is, however, unfounded. The disease or diseases may be obscure in that their life histories are not yet completely worked out, but it is known that the causes of the trouble are due to one or more of three diseases, viz., "Take-all" (*Ophiobolus graminis*), Foot-rot (*Helminthosporium sativum*), and Root-rot (*Wojnowicia graminis*). The effect in each case is very similar to that of "Take-all" (*Ophiobolus graminis*), and all of which attack the roots or lower stems of the plants; each is characterised by root rotting, fuzzy roots, and a darkening of the base of the stem. Each of these diseases with their different characteristics and differences, and those capable of being seen by the unaided vision, are described very fully and very simply in another part of this issue by the Botanist and Plant Pathologist (Mr. W. M. Carne).

Most of the trouble this year has been caused by the parasitic fungus for which the names Basal Stem-rot and Root-rot were suggested by Mr. Carne, but to which he has now given the shorter name of "Root-rot," and which is technically known as *Wojnowicia graminis*. "Root-rot" does not usually become evident until near maturity, and it produces "whiteheads." "Take-all" (*Ophiobolus graminis*) in some instances has precisely the same effect, but the presence of "Take-all," as evidenced by the death of the plants, is also observed in all stages of the plant's growth, even very early in the life of the plant, so that the presence of "Take-all" may be noticed as the result of bare patches during any stage of the growth of the crop, whereas the presence of "Root-rot" is rarely, if ever, noticed until the ears have been formed, and the crop is nearing maturity.

All three diseases are also similar in another respect, they can be controlled, and in the same way. From a farmer's standpoint this is extremely important. In a year such as this one, which has been especially favourable for their presence, crops grown under the best farming practice will show traces of the diseases, but those grown under improper farming practice will be badly affected and probably ruined. The Superintendent of Wheat Farms (Mr. I. Thomas) has drawn my attention to a case illustrating this point, and which occurred on the farm of Mr. Clive Rowan, in the Belka district; last year oats and wheat were grown in the same paddock,

and this year the same paddock was cropped entirely with wheat of the same variety, all of which received the same treatment.. There is a decided and distinct difference between the appearance of that portion of the crop which followed the oats and that which followed the wheat; it is so marked that a very distinct line can be traced between the two sections of this paddock. On that part which followed the oats there is just a trace of "Root-rot," but on the other part the disease is markedly in evidence with numerous and large affected patches.

A heavy and continuous rainfall is not essential to the presence of these "Take all" like diseases; this year their presence is due to the many cloudy days which were experienced during the latter part of the season.

As these diseases are soil borne, in order to control them it is necessary to adopt such methods as will lead to their starvation. This is possible for the fungi responsible for them are parasites, and cannot live for any length of time without a host plant. Plants which act as hosts for these diseases are wheat, barley, barley grass, spear and other grasses. The fact that barley grass, spear and other grasses act as host plants for these diseases, and to tend to maintain their presence in the soil, will explain why wheat crops following pasture—virgin or otherwise—are affected, and sometimes badly affected with these diseases. If the ground be kept entirely free from vegetation, then the fungus has no host upon which to live, and for this reason clean fallow is beneficial in keeping the disease in check; but emphasis must be placed upon the fact that the fallow must be clean and free of plants, because some of the plants other than wheat which grow upon the fallow, such as barley, barley grass and the like act as hosts and so carry on the disease from year to year.

As farmers rely upon the vegetation which grows upon the fallowed land to help feed their sheep, it follows that it is not possible to have the fallows always, and entirely, free from plants. From a farmer's standpoint, and for the purpose of controlling soil-borne diseases "clean fallow" may be understood, therefore, to mean "fallow" on which the vegetation has been destroyed by grazing and cultivation as early as is possible in the spring, but not later than the last month of that season.

Further, it has been found by experience that early fallowing helps in the control of this disease. This phase is illustrated by the experience this season at the Merredin Experiment Farm, where the experiments include plots fallowed in June and also plots fallowed in late August. The plots which were fallowed in June are practically free from any signs of this disease, whilst in those which were fallowed in late August its presence is quite noticeable, though not serious because of the general farm practice adopted which includes the adoption of the three-course system, with fallows which are kept clean by grazing during the winter and cultivation during the spring months of September and October. This illustration will explain why some farmers assert that though they have fallowed still they have this disease; they have not realised that the time of fallowing, as has been shown, has a bearing upon its control, as well as the fact that the weeds in the fallow should not be allowed to grow and mature during the early summer months. The longer the land is *clean* fallowed the more beneficial is the result in controlling these diseases, and in consequence the autumn cultivation of the fallow and seeding as late as is safe for economic reasons, is beneficial in this connection.

Whilst the presence of at least one of these diseases has been observed on oats, the oat plant is not seriously affected by it, and its attack is particularly rare; consequently the planting of oats, which is not normally a host plant for these diseases, tends, as does clean bare fallow, to destroy them by starvation, and in consequence the diseases are not then available to attack the wheat plant. In planting oats for the purpose of controlling these diseases it is emphasised that the oat crop should be only oats, and not a mixture of oats and other seeds, such as barley and wheat, for if the crop consists of a mixture of oats and other plants, provision is made for supplying the disease with a host upon which it can live and reproduce itself in readiness for the next wheat crop.

Summed up the position with regard to these "Take-all" like diseases, and the one that is specially in evidence this year, is—

(1) These diseases have been and are always with us.

(2) The climatic conditions with resulting cloudy days, have been responsible for their abnormal prevalence this season.

(3) Whilst their total eradication is not possible—because 100 per cent. efficiency in farm practice is difficult of attainment—their control so as to cause almost negligible injury is possible, and is entirely within the realm of practical farming practice.

The farming practice necessary to ensure control requires—

(a) The growing of intervening crops of oats between the wheat crops.

(b) Fallowing early and thoroughly for the wheat crop.

(c) The destruction of all plant growth on the fallowed land not later than the last spring month; and

(d) Seeding as late as is practicable in the particular district concerned.

TWO BY-PRODUCTS FOR PIG RAISING.

SEPARATED MILK AND POLLARD.

Recently it was reported to the Department that some settlers were throwing away their separated milk on the ground that, because of the high prices ruling for mill offal, they could not afford to purchase pollard to mix with it for the purpose of feeding pigs. Such an action cannot be too strongly condemned. It is an agricultural sin of the worst kind, for it is wasting a very valuable stock food, splendidly adapted for feeding to pigs, and because it is a by-product of cream extraction, for producing them cheaply.

That it is necessary or even advisable to have pollard to mix with separated milk in order to produce pork on economic lines is based upon misconception. In the first place it is not essential to mix any other food with separated milk in order to raise pigs profitably; they can be, and are being raised on skim milk alone. Better results, but not always cheaper results, are, however, obtained when the separated milk is fed with other food which is complementary to it. Pollard, however, is not the most suitable food for mixing with separated milk for the production of pork, and this

applies to an even greater extent to its kindred by-product of the flour-mill—bran. This latter, though rich in protein and ash, is so fibrous that it is not suitable for feeding to pigs, and especially to young pigs, because of the limited capacity of their digestive organs. Pollard, similar as it is to bran in its chemical composition, on the other hand has been proved to be admirably adapted for feeding to pigs at all stages of their growth, because it contains much less fibre. It is particularly suited for young pigs, for which purpose it ranks second to the by-products of the dairy. Pollard is, therefore, not complementary to separated milk, but may be used as a substitute for it.

The nutritive ratio of skim milk is a very narrow one, and narrower even than that of pollard, *i.e.*, the proportion of carbohydrates and fat to the proteins is less than in pollard. Because of this, suitable food complementary to separated milk is one richer in carbohydrates and fat, and in this connection wheat and barley are excellent. Barley has the advantage that it can be readily grown in the Dairy Belt, and wheat, that it is readily available and the cheapest food on the market at the present time, whereas pollard is amongst the dearest.

Current metropolitan quotations for wheat and pollard are—wheat 5s. 3d. per bushel, and pollard £9 per short ton of 2,000 lbs., or 8s. 9d. and 9s. per cental (100 lbs.) respectively. These rates, however, do not show the true relative value of each for production purposes, for taking the average composition of a number of samples of these foods, which are reduced to a common basis, it is found that the relative nutritive value of these foods may be stated to be—pollard 60, wheat 72.

Having due regard to this phase of the matter, and to the quoted rates of each, it is found that £7 6s. spent on wheat will purchase constituents having the same feeding value as will be found in a ton of pollard costing £9. A comparison of the two stock foods is shown in the following table:—

TABLE SHOWING THE RELATIVE VALUES OF POLLARD AND WHEAT FOR PRODUCTION.

Stock Food.	Rate as on 30th Nov., 1927.	Rate per 100 lbs.	Relative food value.	Cost per food unit for production.
Pollard	£9 per ton	9s. 0d.	60	1·8
Wheat	5s. 3d. per bush.	8s. 9d.	72	1·46

Wheat and barley, when fed to pigs, should be ground or soaked. As the pig does not take readily to dry feed, the latter is believed to be preferable; even when ground the meal should be moistened.

Research work conducted in 1923 by Dr. Crowther and Mr. Chalmers, on behalf of the Royal Agricultural Society in England, proved that the value of separated milk as a food for pigs was particularly good, and greater than that obtained with pea meal. Further, that when separated milk is available a plain cereal supplement furnishes all that is necessary, and no special advantage is likely to be gained from using a mixture of grain and potatoes.

YANDILLA KING AND RUST.

The conditions which were specially favourable for the diseases of the "Take-all" type in the Southern part of the Wheat Belt, namely, cloudy days, have also been the cause of the presence of rust, principally in the middle coastal areas. Whilst the presence of this disease may have caused serious losses in individual cases, the damage to the State as a whole has been almost negligible.

The variety "Federation" is most seriously affected, but fortunately, because of previous experience and warnings, it is planted only in relatively small areas, but "Yandilla King," which hitherto has been regarded as very resistant and almost immune, is this year affected, and is the variety which is affected over the largest area. During the many years "Yandilla King" has been in general cultivation in this State there is no record that it has suffered previously from rust, though in some years some varieties, notably "Federation," planted under similar conditions and in the same district, have been disastrously affected. "Yandilla King" has in consequence been regarded as highly rust resistant.

The occurrence of rust to an extensive and injurious extent is due to favourable climatic conditions which do not imply, as many suppose, periods of heavy or continuous rainfall, but rather, the absence of bright sunny days, and the obvious converse—cloudy weather—which has been so much in evidence during the latter part of this season. Rust to a limited, and normally to a negligible extent, is always present, but before it can occur in disastrous form it is essential that two other conditions shall occur at the same time. These are—

(a) That the plant shall be in a suitable stage; and

(b) That the climatic conditions (absence of bright sunny days) shall be favourable.

Because the climatic conditions favourable for rust usually appear in late spring, the practice has been to produce early maturing varieties, so that they would mature before rust in epidemic form could injure them, and so be rust escaping. Well known instances of this are the varieties "Merredin," "Canberra," and "Firbank." These varieties are rust-escaping, because of their earliness.

In the average season the climatic conditions favourable for the development and spread of this disease occur earlier than was the case this year, and in consequence have passed before "Yandilla King" has reached the stage when the presence of rust could very seriously affect its yield. This season, because the climatic conditions occurred later than usual, "Yandilla King," though a late-maturing variety, was affected, and hence is not rust-resisting as was believed to be the case. This indicates that in previous years it has escaped the rust rather than resisted it, and must, therefore, be included—under Western Australian conditions—with the rust-escaping varieties. The conclusion previously formed was due to the very infrequent opportunities there are, under the climatic conditions which obtain in this State, for obtaining a real and thorough test of ability to resist rust, and illustrates how difficult it is for the wheat breeder in this State to determine whether any variety possesses real resistance to the disease.

Unlike that of diseases of the "Take-all" type, which are soil borne, the occurrence of rust, which in devastating form is due to humid conditions in late spring, can be controlled, to a limited extent only, by the farming practice adopted.

Some of the Durum or Macaroni varieties, such as "Medeah" are so highly resistant as to be immune, but most, if not all, of this type are unsuitable in other ways for cultivation under Western Australian conditions. Other varieties are less resistant, but otherwise are more suitable for Western Australian conditions, examples of these are "Nabawa" and "Gluyas Early." Some varieties are known to be rust-escaping, *e.g.*, "Merredin," "Canberra," "Comback," and "Firbank."

As far as is known at present the only method of possible control of this devastating disease is to plant such rust-resistant or rust-escaping varieties as are otherwise suitable for the local conditions under which they are to be grown.

Because the conditions for an epidemic of rust have been abnormal this year, it is unwise for those who have found "Yandilla King" suitable for their conditions to discard it entirely because this year it has been found rust-infected. It is reasonable to expect in the future, as in the past, that the climatic conditions during the average season will be such that this excellent variety will not be injuriously affected.

Because the prevalence of rust on the crop is due to climatic influence as the crop nears maturity, and to infection from the seed or soil, it is quite a sound practice to use grain from an infected crop as seed, provided it is satisfactory in other respects.

Injury from rust can be minimised by—

(a) the use of varieties which are rust-resisting, *e.g.*, "Gluyas Early" and "Nabawa"; or

(b) those which are rust-escaping, *e.g.*, "Merredin," "Canberra," "Comeback," and "Yandilla King."

SEPARATED MILK AND OATS FOR CALVES.

Seeing that the separated milk is the by-product of whole milk after the cream containing the butter fat has been removed, and that the whole milk of the cow is the natural food of the calf, it is obvious that some other and cheaper food should be added to the separated milk intended for the calves, in order to replace the expensive butter fat which has been removed.

Very many experiments with a variety of foods, including even margarine, have been conducted to obtain information on this point. It has been established that there is no better food for calves than crushed oats to supplement separated or skim milk. Experiments conducted for the Royal Agricultural Society of England by Dr. Woelcker at the Woburn Experiment Station are very informative on this point. The experiments dealt with the problem of how separated milk could best be utilised for calf-rearing—

(a) with spring-born calves:

(b) with autumn-born calves.

Those dealing with section (a)—spring-born calves—were carried out during the years 1912-1914. The results were as follow:—

EXPERIMENT, 1912-1914, WITH SPRING BORN CALVES.

Cost of Feeding and Gain in Live-weight.

Lot.	Food.	Cost per Calf per week.	Gain per Calf per week.	Cost per lb. of Live-weight Gain.
		s. d.	lb.	d.
1	Cod-liver oil and separated milk	2 8·19	9·66	3·33
2	Calf meal	2 0	8·66	2·77
3	Linseed and oatmeal gruel and separated milk	2 4·77	8·33	3·45
4	Whole milk	5 9·22	12·83	5·39
5	Crushed oats and separated milk	2 9·61	13·30	2·52

The rates charged for the feeds used were:—

Separated milk—2d. per gallon.
Whole milk—7d. per gallon.
Cod-liver oil—5s. 6d. per gallon.
Linseed—24s. per cwt.
Oatmeal—17s. per cwt.
Calf-meal—15s. per cwt.
Crushed oats—7s. per cwt.

The crushed oats gave the highest gain and at the lowest cost per lb. of increase. It was clearly the best feeding material of those employed. Whole milk gave the next highest gain, but was considerably more expensive feeding. There was little to choose between the other three feedings.

The experiments dealing with (b)—autumn-born calves—were conducted in 1913-1915, and the results were as shown in the table hereunder:—

EXPERIMENTS, 1913-1915, WITH AUTUMN BORN CALVES.

Cost of Feeding and Gain in Live-weight.

Lot.	Food.	Cost per Calf per week.	Gain per Calf per week.	Cost per lb. of Live-weight Gain.
		s. d.	lb.	d.
1	Cod-liver oil and separated milk	2 0·67	6·54	3·77
2	Calf meal (A)	1 6·77	6·58	2·85
3	Linseed and oatmeal gruel and separated milk	2 0·89	5·71	4·35
4	Whole milk	5 3·93	8·29	7·71
5	Crushed oats and separated milk	2 0·19	8·29	2·92
6	Calf meal (B)	1 7·44	6·20	3·13

The rates charged in the above experiment were:—

Separated milk—2d. per gallon.
Cod-liver oil—6s. per gallon.
Linseed—26s. per cwt.
Oatmeal—20s. per cwt.
Calf-meal (a)—13s. 6d. per cwt.
Calf-meal (b)—15s. per cwt.
Crushed oats—7s. per cwt.

Once more, crushed oats and whole milk gave the highest gains; the cost of feeding with whole milk was, however, much the highest, and the crushed oats came out best; the cost of feeding being practically as low as in any other case.

The general conclusions from these experiments were—

(1) That it is not necessary to feed calves on whole milk for longer than the first fortnight.

(2) That the use of "gruels" is not necessary, but that, as a rule, foods are best given dry.

(3) That, as a supplement to separated milk, crushed oats are an excellent food, and will give as good a return as whole milk fed throughout, and at a much lower cost.

When the period of special feeding required by the experiments, and which generally lasted from 10 to 14 weeks, was concluded, the calves were then turned out and all fed alike, being kept until they were ready—in 1914 and 1915—for the butcher, when the live-weights were again recorded:—"The result was the same as at the earlier period, viz., the bullocks that had been reared, as calves, on crushed oats and separated milk, gave the highest gain in live-weight and at the lowest cost."


STOCK DISEASE

FEEDING TESTS WITH WESTERN AUSTRALIAN POISON PLANTS.

H. W. Bennetts, M.V.Sc.,

Veterinary Pathologist.

In a paper read in August, 1927, before the Royal Society, the writer has given details of feeding experiments, with Western Australian poison plants, which have been carried out during the period from 1925 up till that date.

In most instances rabbits and guinea pigs have been used as experimental subjects, owing to the absence of facilities for dealing with larger animals. However, the results obtained with laboratory animals, with a given plant, appear to agree generally with field evidence of its effect on stock.

Two species of *Oxylobium*, two species of *Isotropis*, one species of *Gompholobium*, some eleven species of *Gastrolobium*, and two species of *Euphorbia* have been tested.

As many different stages of growth as were available for each plant have been fed, viz., seedlings, suckers, leaves of adult plants, and flowers and fruits.

Much information has been adduced as to the toxicity of different stages of growth of the plants under review, also as to symptoms and pathological changes produced in laboratory animals.

Conclusions are to the effect that "the great similarity in symptoms and *post mortem* appearances shown by laboratory animals as a result of the ingestion of species of *Gastrolobium* and *Oxylobium* tested would indicate a similarity of type or identity of the toxic principles contained in the majority. The one probable exception is *G. bilobum*." The effects produced by the majority of Oxylobiums and the majority of Gastrolobiums tested appear to be due to profound nervous stimulation; the pathological changes are typically those of congestion, particularly of liver, lungs, and kidneys. *G. bilobum*, "Heart Leaf," on the other hand, produces symptoms of depression, paralysis, etc., and the pathological changes are indefinite. Seeds of Oxylobiums and Gastrolobiums tested have been found to be very highly toxic, and this toxicity is apparently retained for some considerable period (over twelve months). Seeds are suggested as being the most favourable parts of the plants for chemical investigation.

Isotropis striata, "Lamb Poison," has been found to be non-toxic for laboratory animals, which eat it with avidity.

Antidotes.—Potassium permanganate, especially when compounded in the form of "Poison plant Antidote Tablets," was recommended by E. A. Mann as an antidote for stock in cases of poisoning with *Gastrolobium calycinum*, "York Road Poison," and was also considered to be probably effective for other Gastrolobiums and the Oxylobiums.

The recommendation was based on the fact that Mann isolated a toxic alkaloid from York Road which he considered to be the poisonous principle of the plant. A watery extract of the plant when treated with a small amount of potassium permanganate gave no test for alkaloid, showing that this had been destroyed by the drug. Treatment of poisoned stock with the antidote recommended appeared to give more or less satisfactory results but its efficacy has never been scientifically tested. As doubts have been expressed as to the value of potassium permanganate as an antidote it was decided to test its effect on the toxicity of Gastrolobiums and Oxylobiums.

Carefully controlled experiments have shown that potassium permanganate, even in the form of "Poison Plant Antidote Tablets" has no effect on the poisonous properties of the following plants:—

Oxylobium parviflorum, "Box Poison."

O. tetragonophyllum (tablets not tried).

Gastrolobium bilobum, "Heart Leaf Poison."

G. calycinum, "York Road Poison."

It was found that portions of these plants, seeds, buds, etc., in finely divided condition, even after soaking for four to five hours in solutions containing an excess of antidote were just as toxic for laboratory animals as if not so treated prior to feeding.

Conclusion.—Potassium permanganate even in the form of "Poison Plant Antidote Tablets" is not likely to be of value as an antidote in cases of poisoning of stock with plants belonging to the genera *Oxylobium* and *Gastrolobium,* which genera include the majority of the W.A. poison plants.

HORTICULTURAL NOTES.

Geo. W. Wickens,
Superintendent of Horticulture.

SEASONAL WORK FOR JANUARY, FEBRUARY, AND MARCH.

January.

Though this is a month when fruitgrowers, particularly those who own orchards comprised of stone fruits, will be mainly engaged in marketing the crop, time must be found to combat the pests which take toll of the results of the orchardists' labours.

Fruit Fly is the worst enemy in this connection so far as Western Australia is concerned, and there is evidence from the early start which it has made this season, and the good crop available, that special care must be taken by growers to keep the pest under control, or the losses will be heavy. There is no sudden death method of accomplishing this: nothing but constant vigilance and attention to detail will serve the purpose. Daily gathering up of windfalls, daily destruction by boiling of all infested fruits, foliage baiting, and trapping must all be carried out before control can be attained, and the grower in the infested area who neglects to take these necessary measures not only suffers loss in his own orchard, but is a menace to his neighbours as well.

Opportunity is again taken in these notes to remind apple and pear growers that Codlin Moth was present last season in two districts in the State—Collie and Narrogin—and though excellent results were obtained in the war waged against it, and its eradication in those places is confidently anticipated, the fact must be borne in mind that just as it gained entrance there so it may to any other fruitgrowing portion of the State, and every grower should carefully note any suspicious tunnellings in his fruits and notify the Department at once. Its presence in fallen apples or pears will be easily detected this month, and it is only by the wholehearted co-operation of growers and officers of the Department such as has obtained in past outbreaks that the pest can be subdued.

Powdery Mildew is showing up in many apple orchards, and should be treated by spraying with atomic sulphur. Where Red Mite is also prevalent a nicotine decoction can be added to the atomic sulphur spray.

Red Scale on citrus trees has been held in control for several seasons by the parasite—*Aphelinus diaspidis*—but last season it was noticed that the pest was more prevalent in some districts in the hills near Perth than it had been during the three previous seasons. Should it show sufficiently during this month to endanger the fruit being spotted, spraying must be resorted to, but the increase of the pest is nearly always closely followed up by an increase of the parasite, and some infested trees should be left unsprayed so as to provide breeding places for the little friends of the fruitgrowers.

The soil in all orchards should be kept in a thorough state of tilth during this month by scarifying and/or harrowing.

February.

Fruit picking, packing, and marketing is again the major operation in deciduous orchards, and usually towards the end of the month the first apples for the season are gathered for shipment overseas in boats leaving either at the end of February or very early in March. Though the apple crop is undoubtedly the lightest experienced for many years, and at time of writing (November) it is impossible to forecast what quantity will be available for shipment, it is certain some shipments will be made, and growers are strongly advised to take note of the articles on Bitter Pit, which appeared in the September issue of this Journal, and avoid picking fruit which is immature, for such fruit is practically certain to develop Pit after it is gathered. Western Australia has made a name for high quality in apples in the overseas markets that so far has not been equalled by any other State in Australia, and special care is needed this season to avoid damaging that reputation. This does not refer only to gathering immature fruit with its consequent affection by Bitter Pit, but it cannot be too strongly impressed upon growers that light crops of apples always mean a large proportion of inferior fruit. Many "Dunns," even now (November), are russetted and cracked; many "Cleopatras" are ill-shaped; and many "Jonathans" will be over-sized, and these must not be shipped overseas to the detriment of the good reputation which has taken years to acquire.

Possibly some growers who read these notes may think that writing in this strain in a year of misfortune is akin to rubbing salt in an open wound, but there is too much at stake to take chances in shipping poor quality fruit, and to add the disability in future years which would follow on such action, to that of a partial crop failure in this, is something that cannot be thought of. So even though it may appear hard, the Port inspectors will carry out their duties just the same as though it were a season of plenty, and fruit deemed unfit for shipment will be rigorously rejected.

Advice *re* Fruit Fly and Codlin Moth given in notes for January apply with equal force for February.

March.

This is the busiest harvesting month of the year for fruitgrowers in Western Australia, many varieties of apples, pears, grapes and stone fruits being in a stage of ripeness which necessitates gathering and marketing to avoid loss from wastage; and this is also the month when Fruit Fly does the greatest amount of damage, and unfortunately on account of pressure of other urgent work is most likely to be neglected; therefore, once again, in spite of the danger of being accused of vain repetition, growers are advised of the absolute necessity of—

Daily destroying all infested fruits;

Foliage baiting once in every seven days;

Trapping with an effective lure.

Department of Agriculture. Horticultural Exhibit, Royal Agricultural Show.

LAMB PRODUCTION.

Hugh McCallum,
Sheep and Wool Inspector.

During the past few years interesting experiments have been made in crossing of various breeds of sheep for the production of fat lambs. In this State yearly increasing attention is being given to the building up of better flocks, and we must realise that if our lamb and mutton trade is to hold its own in the markets of the world we must compete successfully on the basis of quality. Many breeders must pay stricter attention to breeding principles and supply the markets' demand with prime quality only. Anything other than prime will only with difficulty find a buyer in a market perhaps fully supplied with prime production, and then at an unpayable price.

With the approach of the breeding season special attention must be paid to the selection of both rams and ewes. Undoubtedly the influence of the ram must be given first consideration, for on his quality and stamina will depend, to a very great extent, the size and maturing quality of the lambs. The ewes, of course, should have recuperated from the strain and tax of nursing lambs, and should enter the season in full bodily vigour, as the condition of the ewe is of great consideration at the time of mating.

The safest course always, whether with small or large flocks, is to use pure-bred rams. First ascertain the best type of ram to cross with the ewes selected for fat lamb breeding, or at least the type of ram which will produce in the progeny the best economic results.

Cross-breeding is only a means to attain a desired end, and it must always be remembered that cross-breeding cannot ever be anything other than supplementary to the principles of breeding for true type and pure blood, and the best results in cross-breeding are obtainable only by the crossing of the best types of the respective breeds employed in that cross. The further the crosses become removed from the parent sources, the more they deteriorate, and the value of the original cross becomes greatly impaired. Some breeds acquire greater distinction as a means of crossing than they do as pure-breds; that is to say, there is a far greater demand for rams of some breeds for crossing purposes than for use in pure-bred flocks. It is incumbent, however, on breeders of pedigree flocks to do all in their power to maintain their flocks true to type, and to see to it that those characteristics are maintained which render the breed valuable for crossing purposes, as cross-breeding can only be carried on by the maintenance of pure-bred flocks of various breeds.

Western Australia offers almost unbounded possibilities for the extension of the lamb-raising industry. During the past season several consignments of lambs, equal to any in Australia, have been sold at Midland Junction for the local and export trade.

Many types of British breeds and Corriedales can be purchased from the breeders of these sheep in the State. These studs are a credit to the owners, who have spared neither money nor time in the selection of the best possible. The prices realised at the Royal Show sales for these sheep was an outstanding feature.

GREY SPECK DISEASE OF WHEAT AND OATS
(known as White Wilt in Western Australia).

W. M. Carne, F.L.S.,
Economic Botanist and Plant Pathologist.

During the past year, and for the first time in Australia, this disease has been independently identified both in this State and in South Australia.

It is a well-known disease on the Continent of Europe, where it receives the name of "Grey Speck" disease of oats. In this State it has been known as "White Wilt," and in South Australia as "Roadside Take-all."

The attention of this Department was first drawn, in 1922, to the disease at Dwarda by Mr. A. T. O'Connell, who recognised that it was different from the yellowing caused by excessive water and nitrate starvation in wet soils. Mr. O'Connell has since then each year carried out a series of experiments in conjunction with this Department. His interest in the problem and his attention to detail in carrying out the experiments, and in observing the results have alone rendered the field work possible. The information from which this article has been prepared has largely been gathered at Dwarda. At the same time no evidence has come to hand to indicate that the disease may occur elsewhere under other conditions.

So far as known, the disease is confined to Great Southern Districts extending from about Beverley to Broome Hill in the south, to Kulin and Moulyinning in the east, and westward from Narrogin to the Darling Range.

It is associated with Brown Mallet (*Eucalyptus astringens*) and Wandoo (*E. redunca* var. *elata*), and in the writer's opinion is closely related to the distribution of the former. It would appear probable that Mallet is a disappearing species, and that the occurrence of the disease beyond the present range of Mallet (as at Beverley) is connected with its previous wider range. Wandoo is not definitely linked with the disease, having a range far beyond that of Grey Speck. The present association of the disease with Wandoo would appear to be related to soils on which the latter has replaced Mallet.

Relation to Soils.

Grey Speck is associated with Mallet and Wandoo, or with Wandoo in Mallet areas. It occurs principally on gravelly hill-sides in which the ironstone gravel is associated with a light, floury, grey, loamy soil. In places, though less affected, this light floury soil is practically free from gravel. Mallet on the affected areas is associated with ridges with a lateritic (?) cap which weathers readily and easily breaks down into the floury soil and gravel. Where the cap has been denuded, Wandoo occupies the ground, but the gravelly soil is similar to that below the mallet ridges. Grey Speck has not been noted on alluvial soils such as river flats or on lower slopes except in conjunction with the gravel or lateritic (?) outcrops.

The origin of this laterite (?) is unknown. It is quite distinct from that of the Darling Range.

Chemically the soils are poor but are notable for the relatively high content of calcium carbonate and their alkalinity when dry in the summer (pH. ranging from 6.4 to 9.5). After the winter rains they become slightly acid. The soils in the area are very variable, and those mentioned are interspersed with granitic types. Those liable to the disease carry good pastures of annual clovers and grasses after cropping, and make good sheep country. They give good hay crops in the seasons when the disease is not severe.

Symptoms.

The disease makes its appearance in June or July, appearing as stunted yellowish or whitish patches in the young crops. These patches start from centres and may not extend individually over more than two or three square yards. In other seasons these may enlarge and run together to cover areas of several acres and upwards. The uncertainty of predicting the exact location of the trouble has been a factor causing difficulties in experimental work. In field experiments it has been overcome by using narrow plots upwards of 12 chains long, which ensured that whatever the seasonal occurrence, affected areas would somewhere cross the treated and control plots. Under normal seasons, about the end of August the affected patches show signs of improvement and then rapidly recover, yielding almost normal crops. In severe cases the plants may be too affected to recover; this applies more to wheat than oats. Should the season of recovery coincide with a droughty period, the affected areas may fail completely. There is no doubt that the disease looks more serious than it really is. Seen at its worst, an absolute failure of the affected areas would appear inevitable. Yet in good seasons it may be almost impossible to detect these areas a month or two later. It would appear that in Europe and in South Australia the trouble is more serious, and that without special treatment crop failure is normal.

Viewed superficially, Grey Speck may be confused with the yellowing which occurs in low waterlogged places due to nitrate and oxygen starvation of the roots. Grey Speck, however, has not been associated with wet land, and test drains put in by this Department showed neither evidence of need of drainage nor any beneficial result therefrom. The occurrence of both diseases has been noted in the same paddock, but while Grey Spec occurred on the slopes, waterlogging occurred on the lower and more level land.

Close examination of the affected plants, especially in the early stages of the disease, soon discovers definite and distinctive symptoms by which it may be recognised. While the first seedling leaf is a normal green, later leaves are a faintly yellowish green when they first show, the difference being readily detected by comparison. Somewhere about the centre, usually about the natural bend of the third leaf blade, spots appear. These are light coloured with a pinkish tinge, but later develop grey centres. In oats the lesions may be surrounded by a purplish margin. The spots start both at the edges and in the centres of the leaf blades and extend until they meet across the leaf, forming a dead irregular grey band while the blade at both ends is still green. The leaf collapses at the dead area and the upper half hangs down. The dead area extends and shrivels and the balance of the leaf turns yellow and then greyish-white as it dies. The spots are not confined to

Grey Speck on Algerian Oats.

A-B affected seedlings. C-E Details of leaf lesions.

one point, but may also develop above and below the main lesions. By this time other leaves have become diseased and the affected plants develop the characteristic appearance which has earned the name "White Wilt." Examination of numerous seedlings indicates that in the majority of cases the third leaf is the first to show the lesions, followed by the second and fourth, and then the first and fifth, and then in order of appearance. As new leaves are formed, they are affected and eventually killed, so that the plants remain stunted until they recover with warmer weather in August and September or fail altogether.

Investigations.

It is not intended in this paper to cover the experiments in the field and in pots, or the laboratory investigations which have been undertaken since 1922. These were started by Mr. Baron-Hay in conjunction with Mr. O'Connell. In 1925 the subject came under the attention of the writer, who has carried on investigations as opportunity offered and within the limits of his equipment. As a result of field tests it has been found that good control can be obtained by using—

1. Iron sulphate as a dressing on affected areas at the rate of 4 to 5 cwts. per acre.

2. Finely ground sulphur applied to soil two months before sowing at the rate of 2 cwt. per acre; and

3. Manganese dioxide 72 lbs. plus sulphate of ammonia 56 lbs. per acre applied at sowing time.

Nearly as good results were obtained when iron sulphate 112 lbs. or sulphur 112 lbs. was substituted for the sulphate of ammonia in 3. Manganese dioxide used alone in varying quantities gave only a partial improvement. Other field experiments showed no control from the use alone of lime, organic manure, nitrate of soda, sulphate of ammonia, gypsum, and as previously stated, drainage. Pot experiments, covering a greater range of treatments, in the main confirmed those in the field, excellent results being obtained from manganese dioxide plus sulphate of ammonia, which gave results superior to any other treatment. Manganese sulphate and manganese dioxide alone did not give satisfactory results. The former, which has come into general use in Europe for this disease, is there considered superior to the dioxide, but is much less readily obtainable here at present. Unfortunately it was not tried with sulphate of ammonia but with nitrate of soda which latter did not give the results obtained with sulphate of ammonia in any of the tests. 90 lbs. superphosphate is normally used per acre at Dwarda, and equivalent amounts were used in all experiments.

Cause of the disease.

It would appear that a deficiency of available nitrogen and some chemical defect of the soil associated with calcium salts and low temperatures are primarily responsible. This defect is overcome by the use of sulphur, sulphate of iron and manganese dioxide. Several theories have been proposed in Europe, but a more satisfactory explanation may be found in results obtained by Messrs. Samuels and Piper at the Waite Agricultural

Research Institute in South Australia this year. These indicate that the primary soil defect is a lack of available manganese, though the soils are not deficient in this element. The writer was fortunately able to see something of these experiments, and was able to confirm the identity of the disease in the two States. As the Waite Institute is carrying on the research, no further detailed investigations will be attempted here. It is, however, proposed next season to test manganese sulphate plus ammonium sulphate as a dressing on affected areas after the disease appears.

The solution of the cause of the disease, and how it operates, will probably take longer than to find an effective control. The writer has had some evidence that the lesions are due to bacteria attacking plants in an unhealthy condition as a result of the soil defects. Tests with bacteria isolated from the leaf lesions indicated that infection occurred from drops of water collecting between the partially unfolded and the folded leaves of the growing point. These tests require confirmation.

Control Recommendations.

The opportunity arose at Dwarda of comparing the incidence of the disease in one crop on affected land sown to cereals, two, four and six years before in adjoining blocks. The disease had led to portion of the paddock being withdrawn from cultivation in 1921, and an extension of this area in 1923, the balance being cropped and diseased in 1925. In 1927 the whole area was cropped and the disease, though occurring throughout, was distinctly less marked in the areas not cultivated in 1925. It would appear that, pending the final solution of the problem, it would be advisable to crop the affected areas not more than once in four years.

The chemical treatments, so far found successful, are too expensive, taking into consideration the value of the land concerned and the uncertainty of crop failure on affected areas. For instance, the affected areas at Dwarda, 1927, all gave good crops.

Summary.

White Wilt of wheat and oats in Western Australia is identical with the Grey Speck Disease of oats in Europe and the Roadside Take-all of South Australia.

In this State it is associated with Brown Mallet or Wandoo in Mallet country. The disease appears as yellow or whitish patches on hillsides. These are first noticeable in June or July. By the end of August or early September the affected areas either recover and produce nearly normal crops or fail. Failure depends upon unsuitable climatic conditions for growth in August and September.

The disease has been experimentally controlled by certain chemical treatments. It is possible that some such treatment may be found which will be economically justified.

For the present the evidence available indicates that cropping not more than once in four years causes a definite reduction of the disease.

THE ZONE SYSTEM OF HERD IMPROVEMENT IN W.A.

P. G. Hampshire,

Superintendent of Dairying.

A scheme for the improvemnt of dairy herds in Western Australia was first launched at a Conference of Officers of the Department of Agriculture and the Agricultural Bank, at Bunbury, in June, 1923, when the scheme of dividing the State into zones, and the supply of pure-bred bulls—ex officially tested dams with production above standard—was submitted. This Conference adopted the policy, and it was instituted in the supply of bulls to Agricultural Bank clients. With the supply of stock to the Group Settlements this herd-improvement policy was also adopted.

In the early stages of the policy three breeds only were catered for, namely: Milking Shorthorn, Jersey and Guernsey. Following on conferences with the breeders and the Royal Agricultural Society and the Department it was decided to admit the other dairy breeds, namely, Friesian, Ayrshire and Red Poll, on the understanding that the breeders of the last-mentioned breeds would submit their herds to the Official Australian Pure Breeds Herd Testing Scheme with a view to providing bulls with the necessary qualifications for use in the zones allotted to the breeds.

Following on this, the interest taken by the breeders of the three breeds mentioned was so lax that the matter of the re-allocation of the zones to provide larger territory for the Milking Shorthorn, Jersey and Guernsey breeds was brought up at the annual meeting of the Royal Agricultural Society. A special sub-committee was appointed to go into the question of the re-allocation of the zones and the accompanying map is the result of their deliberations and has been endorsed by all parties concerned.

That the policy of zone breeding is a success has been acknowledged upon all sides, and anyone who has travelled the Milking Shorthorn, Jersey and Guernsey zones in W.A. recently will be at once struck by the efficacy of the policy. The progeny of these bulls mated to average-type dairy cows are almost invariably indelibly stamped with the type and colour of the sire, and, whilst it is somewhat early to be definite in regard to the scheme, everything points to it being a great success.

In the allocation of the zones the principal features determining the breeds were—

1. Suitability of the breed climatically.
2. Suitability of the pasturage.
3. Suitability of the produce of the breed in marketing.
4. Consideration of the sale of the male cross-bred progeny.

The advantages of the scheme are:—

1. Definite policy of continuity in the grading-up of the ordinary common cattle to one breed and by the utilisation of registered pure dairy sires, the progeny of proved production cows, so the milking qualities of the progeny are improved upon. Type and production are improved with each generation.

The working of the scheme lends itself to the continued use of a sire of the same breed, and each successive generation of heifers becomes automatically improved, in place of, as where no policy is in existence, a tendency

DEPARTMENT OF AGRICULTURE

MAP

OF

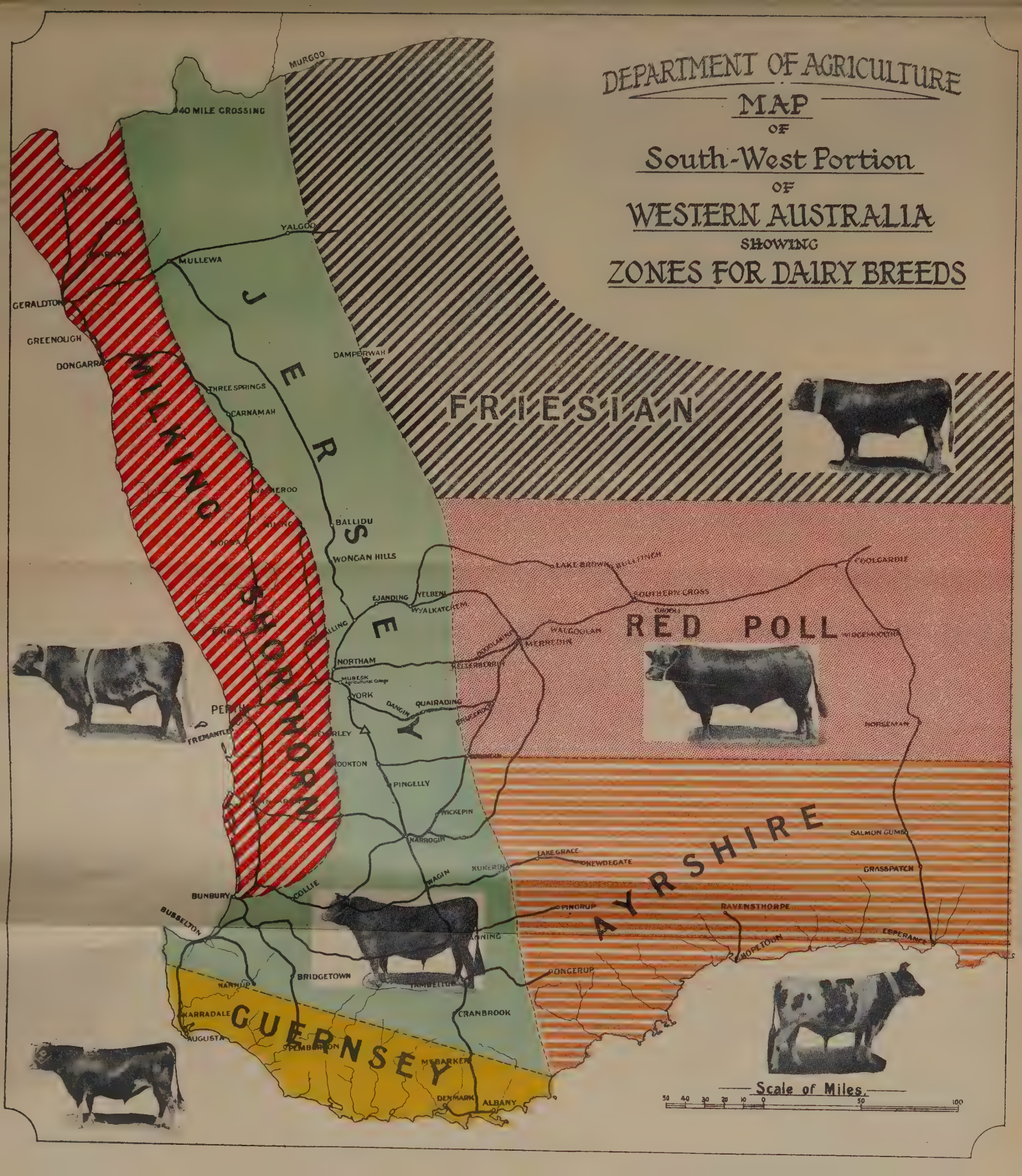
South-West Portion

OF

WESTERN AUSTRALIA

SHOWING

ZONES FOR DAIRY BREEDS



to chop and change the breeds with each mating and thereby undo the breed improvement sought after.

2. *Exchange of Bulls.*—With the policy in operation, the exchange of dairy sires is made easy. Owners of bulls, when the time is necessary to look to a change, can readily select close at hand a bull of the same breed and mutually agree upon an exchange, thus effecting a considerable saving in time, worry and expense in so doing.

The scheme also permits of sires which are obviously outstanding in regard to their progeny being returned to owners' herds. Under the system in operation each sire is fire branded with a number and all the progeny of this sire are similarly branded.

3. It has been found already that zone breeding greatly increases the interest of the dairy farmers and creates district interest in the breed, resulting in Agricultural Societies developing the particular breed at their shows and giving the principal prizes and greatest number of classes to animals of the zone breed and generally improving the exhibit of cattle at their shows. We already have the principal towns in the different zones standing out in cattle of their breed. Northam and Bunbury in the Jersey; Harvey and Perth environs in the Milking Shorthorn, and Manjimup, Karridale and Denmark in regard to the Guernsey.

In the development of the scheme outstanding settlers are securing pure-bred females and so becoming breeders of sires for distribution in and round their district.

To date 316 bulls have been purchased and distributed under the scheme, representing approximately £1,200 which the West Australian Government has provided for the purchase of high class dairy sires, which are distributed on very easy terms of repayment.

The numbers of the bulls of the different breeds allocated are as follow:—

Guernsey	133
Milking Shorthorn	112
Jersey	71

Indicative of the production quality of the sires in use, the following table sets out the production of their female ancestry:—

Breed.	No.	Average Yield in Butter lbs. of—		
		Dams.	Grand Dams.	Great Grand Dams.
		lbs.	lbs.	lbs.
Guernsey	133	423	476	615
Milking Shorthorn	112	356	423	533
Jersey	71	461	463	493

When it is realised that the average cow of Western Australia only produces approximately 100 lbs. butter per annum, the potential improvement that should take place as the result of mating these high production bred bulls with the average cow will be appreciated, in view of the accepted theory that each parent contributes 50 per cent. towards the progeny.

Department of Agriculture. Pedigree seed display at Royal Agricultural Society's Show.

SUBTERRANEAN CLOVER.

(*Trifolium subterraneum* L.)

A. B. Adams, Muresk Agricultural College.

W. M. Carne and C. A. Gardner, Department of Agriculture.

Subterranean Clover, which received its name from its habit of burying much of its seed in the ground, is undoubtedly the most important clover and also the most important pasture plant in the South-Western Division of the State. It came into general notice some ten or twelve years ago with such favourable results that during recent years the area under this clover has increased by leaps and bounds, and will certainly continue to do so for many years.

All natural species of plants when brought into cultivation soon show they are collections of closely related but distinct pure-breeding sub-species or varieties, with perhaps crossbreds between these forms which are not pure-breeding. Though as yet the results of the scientific determination of these pure-breeding varieties in Subterranean Clover are not available, accident or climatic factors have separated three or four varieties or groups of similar varieties.

1. *The mid-season variety* constitutes the great bulk of the Subterranean Clover pastures of this State. This is the form which has attracted most attention and the seed on the market, whether locally grown or from South Australia, is usually of this variety. It apparently received its first impetus in the South-West as a result of seed obtained from South Australia about 1908, though plantings from seed from that State had been made as early as 1902. The leaflets have normally a whitish crescent-shaped patch about the centre, and scattered brownish flecks on the veins. The calyx is usually a light red in colour. This variety makes a heavy growth of foliage before flowering. Flowering commences about mid-September in the earlier districts and mid to late October in the later Southern areas.

2. *Early variety.*—This has been known in the Upper Blackwood district for about 40 years. Mr. P. D. Forrest considers that it was accidentally introduced there by his father in rye grass seed. The leaves of this variety have brown flecks in the earlier leaves and the white markings of the mid-season form, but these tend to disappear later. The calyx is green or pinkish. The leaves are more widely spaced and the bulk of foliage produced is considerably less than in the midseason variety. When first sown and with a thin stand it has a trailing habit and looks unattractive with its long runners and scanty foliage. When established and growing more densely it produces a thick mat of herbage. It is hardier than the midseason variety and does better on light dry soils. It commences flowering about mid-August around Muresk and York and towards the end of September in the later districts. Its early flowering and seeding habits promise well for districts where the rainfall is too light (under 20 inches) or where it ceases too early for the mid-season variety. This clover has proved its value at York, where it was introduced accidentally on to the Daliak property of Mr. A. J. Monger. The sheep have carried the seed and by topdressing the

clover has been successfully established on 2,500 acres with excellent results on the stock-carrying capacity. Mr. Monger's experience will certainly lead to a great increase in the use of this variety in the Avon Valley.

3. What appears to be an early variety intermediate between the early and mid-season forms was found this year at Muresk. In habit of growth it is akin to the mid-season, being denser and less trailing than the early variety. The leaves have no markings and the calyx is a dark red. It flowered a week or two later than the early variety and appeared to prefer a rather stiff soil and did not do so well on light soil as the latter. Nothing is known of its origin.

4. *Late variety.*—This is a strong growing form, less hairy than those already mentioned and lighter green in appearance. The leaves have no colour markings and the calyx of the flower is pale green. It flowers about two weeks later than the mid-season variety and is even less capable of ripening seed if the ground is hot and dry. This form has been known around Wenigup in the Bridgetown district for many years but nothing is known of its origin.

Growers who have not been successful in establishing Subterranean Clover on their properties owing to low rainfall, and to dry weather setting in too early in the spring are advised to experiment with the early variety.

General Notes on seeding habits.—Subterranean Clover seeds best if the flowers are shaded. There are usually three flowers to each flower cluster. When in bud, and as the flowers open, the stem is upright; when the flowers are fully open the flower stem bends over and brings the flower cluster on to the soil. As the stem bends over, the flowers fold back along it so that the bases of the flowers come in contact with the ground. Outgrowths from the bases of the flowers then penetrate the soil, if the conditions are suitable, and draw the flowers under the soil where the seeds mature. This burial of the seed would only appear to take place if the conditions are suitable. The most favourable condition is for the surface of the ground to be moist. If the soil is dry but so shaded with vegetation as not to become hot the seed will mature on the surface of the soil. If the soil is dry and hot there is great risk of the flowers shrivelling on coming into contact with it and failing to set seed at all.

This fact has a practical bearing on the establishment and management of Subterranean Clover.

Suitable Soils.—Subterranean Clover is adapted to almost all soils except the driest sands and wet swamps. It will, however, stand a lot of water in the winter if the clover gets an early start.

How to establish.—It can be established on—(a) cultivated land or (b) bush land that has not been ploughed. On cultivated land clean seed is best sown with a cover crop such as oats. It may be sown through a drill mixed with the fertiliser. It is advisable to mix the seed and fertiliser the day it is sown. The drill should be set to just cover the oats with soil. The oats may be either fed off or cut for hay. The use of a cover crop is important as the plants develop better and set more seed if somewhat shaded.

In an experiment 2lbs. per acre of clean seed with oats gave a better result than 7lbs. alone on the same land. On uncultivated bush land the seed is best broadcasted after the timber has been rung and preferably after a fire has been over the area. In the moister districts Italian Rye Grass may be sown with it to act as a cover and to give some feed the first season. It it not necessary to cut out all the smaller scrub and bracken as a certain amount of shade is desirable the first year. Where the ground is bare and hard between the trees it would probably be advantageous to break up the surface soil, otherwise it should be left in its natural state.

When to Sow.—Although early sowing is advisable it is possible to sow too early and to catch an early rain succeeded by a hot spell which may kill the seedlings. In the wetter districts the end of March or early April is probably the best time. In drier districts as in the Avon Valley it should be sown with the first general rains. Late sowing is very undesirable as the plants make little growth in the winter and are liable to set seed badly in the spring. In all cases phosphatic fertilisers must be used when sowing.

Quantity of seed for sowing.—The quantity and best kind of seed to use is a debated point among growers. The seed may be—

(a) Clean, machine-dressed seed, either of local or South Australian origin. General principles of acclimatisation would indicate a preference for the former.

(b) Clean burr, consisting of the seed pods and their enveloping structures free from rubbish. 3lbs. of clean burr is equivalent to about 1lb. of clean seed. This type of seed is relatively limited.

(c) Burr of the type usually sold. This consists of burrs raked or swept up from a clover paddock together with rubbish such as plant fragments, small stones, etc., and the seeds of other plants. These seeds may be of useful grasses and clovers or of objectionable weeds. It is always possible that dodder seeds may be present. This parasitic noxious weed is unfortunately well established in many subterranean clover pastures and there is little doubt that its spread to new areas has largely come about through the use of ordinary burr. Clean Subterranean Clover seed is not likely to contain dodder seeds, as they are much smaller than the clover and would be removed in cleaning.

The best kind of seed to sow will depend on circumstances, for the farmer who has Subterranean Clover already growing, the best and cheapest method is to obtain his own seed by sweeping the paddock. It should be stated here that, on an old established paddock, no matter how bare the ground is swept there will be no fear of spoiling the paddock. In actual practice where a paddock was swept as bare as possible there was quite a good stand of clover the next season. If the seed has to be purchased clean seed at a reasonable price is the best, because it is, or should be, free from weed seeds and there is no excuse for dodder to be present. In actual germinating power it has been found from experiment that clean (de-hulled) seed contains about 20 per cent. of hard-shelled seed, and ordinary seed in the burr has about 80 per cent. An average bag of burr has been found to contain three to four pounds of seed, though some bags are much lower than this, and some containing little straw go as high as

even seven or eight pounds. In practice 1lb. of clean seed will be about equal in germinating capacity to an average bag of burr. The advantages of clean seed are that it has—

(1) A higher germinating capacity. Most clover seeds are the better for being scarified, as this scratches the hard coat of the seed and enables it to germinate better, and in going through the dehulling machine much of the subterranean clover seed is scarified, and so germinates more readily.

(2) It is much easier to distribute evenly.

(3) If sown on a bush burn, or on hard ground, it is more easily covered and is less liable to get washed into heaps.

(4) Its freedom from dodder and weed seeds.

If sowing on very roughly ploughed or on very open soil the burr is probably the best, as there is a danger of the clean seed being buried too deeply for good germination. Many failures are doubtless due to too deep sowing. Too thick a sowing is not of much advantage, as what is desired is sufficient plants to produce plenty of seed for the following season, and with a reasonable germination 1lb. of clean seed or one bag of burr sown with oats or other crop will be quite enough. When sowing on a bush burn, or existing pasture, the same amount of seed, 1lb. clean seed or one bag burr, will generally be found quite sufficient. If it is very necessary to feed it off the first season and the land is very good, it will pay to use more seed than the above, but generally, whatever amount of seed is sown, the results are better the second season than the first.

Once this plant is established it will be spread by the stock passing the seed with the droppings, particularly on topdressed pastures; cattle spread it readily, and sheep spread it not only by carrying the seed in the wool, but by passing it in the droppings. Sheep at Noggerup, having the run of a subterranean clover paddock and topdressed bush, carried the subterranean clover from the former to the latter, and, as a result, there is quite a useful stand of subterranean clover in the bush.

Manuring.—Phosphatic manures are essential for success with clovers. Subterranean Clover responds extremely well to the fertilisers, of which superphosphate and basic superphosphate are recommended. On some soils the difference caused by a light application of superphosphate is remarkable. Whatever the soil, it is advisable to manure at the rate of 1½ to 2 cwt. of superphosphate per acre the first year, topdressing with about 1cwt. each season after. On the poorer soils, for the first year's application nitrosuper. can be substituted for superphosphate with advantage as the young clover plant is at first dependent on a supply of available nitrogen in the soil—later in common with other legumes it is able to obtain nitrogen from the air. When first sown the manure should go in with the seed. In succeeding years topdressing may be done at any time after the first rains until about August. To secure a good stand of hay on grazed clover a second topdressing should be applied, the first with the early rains and the second about August.

Some general considerations.—As quite good pastures may be established on virgin soil under dead timber without cultivation, little is to be gained in going to the expense of clearing, ploughing and cultivating. In actual prac-

tice better results may often be obtained where the soil has not been disturbed. In one case noted 15lbs. of clean burr per acre sown on clean land cultivated after peas did not give the results obtained from 3lbs. per acre applied to existing pasture when topdressed.

It is a mistake to turn sheep into Subterranean Clover when the seed is germinating, though the risk is reduced if there is plenty of dry feed. Sheep are very effective in distributing the seed. Mr. A. J. Monger at York has relied almost entirely on this in spreading the clover. When the clover land is cropped, he leaves uncultivated the wetter areas. These are given a dressing of 180lbs. of superphosphate per acre (90lbs. is normally used at Daliak) and grow a dense mass of clover. When sheep are placed on the stubble they carry the burr back to the cultivated land and thicken up the succeeding clover stand which had been thinned by the cultivation.

Growers are warned against leaving a heavy mat of dry feed on the land until the rains. As the dry vegetation retains the moisture the seed in it is caused to germinate without coming in contact with the soil, and the seedlings are likely to dry off. The best method of dealing with a heavy growth is to cut it for hay if it is not grazed off in the summer. When cutting for hay the best time is probably when a good supply of burr has been formed, but before the seed is ripe. If cut earlier the clover is too sappy to make good hay. The plants should then be allowed to ripen seed for next season before being grazed.

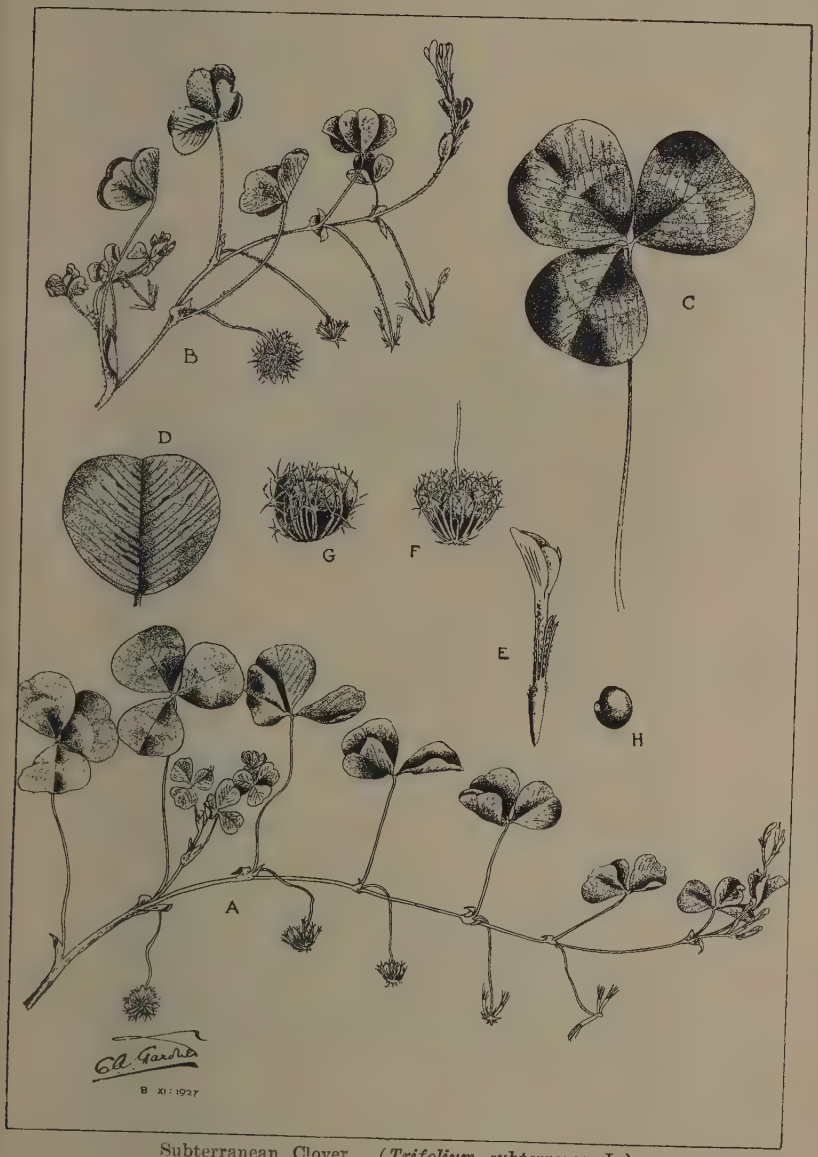
When established in uncleared country a lot of scrub and undergrowth will probably grow up. If so, it is advisable to put a fire through the clover at the end of summer to check the scrub without injuring the clover seed.

If the clover is badly infected with lucerne flea or the red-legged earth mite—two pests which may seriously affect the plants before the weather warms up, a fire at the end of summer will be beneficial. Mr. A. J. Payne, of Boyanup, reported that a fire got away in a paddock which he had reserved for feed. It had been badly affected with these insects the previous year but was clean in the year following the fire.

The advantages of Subterranean Clover.—Not only does Subterranean Clover increase the carrying capacity of the districts suited to it, but it also gives earlier feed in the autumn than other pasture plants. The seed is larger than in other clovers and when the pasture is dry these are picked up by the sheep and some are digested by them. In the drier districts it does not dry off as quickly as the grasses, crowfoots and trefoils.

Through its habits of seeding, though an annual, Subterranean Clover produces to all intents and purposes a permanent pasture, which breaks into new growth with the first general rains of each season.

Description of Plant.—A prostrate annual plant of spreading habit, more or less clothed with silky hairs, varying from very hairy to almost without hairs. Stipules broad, lanceolate, acute. Leaves on long stalks, the leaflets broadly obovate. Flowers two or three together on axillary peduncles, at first erect, lengthening considerably after flowering and turning down to the ground. The upper flowers of the head are barren, forming short, whitish barbed processes, each with five spreading pointed teeth, and repre-



Subterranean Clover. (*Trifolium subterreum*, L.)

Explanation of Plate.

A. and B. Portion of plant showing habit and development.
C. Leaf showing whitish crescent-shaped markings.
D. Leaflet with brown flecking (on veins near midrib).
E. Flower.
F. Maturing seed head.
G. Ripe burr with three pods.
H. Seed.

sent undeveloped calyxes. When the peduncles curve downwards the fertile flowers turn back upon the peduncle, and the inner barren flowers become outermost and surround the fertile flowers, protecting the maturing pods.

Should there be humus or litter upon the ground, or, if the soil is loose, the ripening heads penetrate, and the barbed organs serve to anchor the "burr" in the soil.

The flowering calyx varies from white to green or red; the tube is without hairs, many-nerved in fruit, and the lobes are long and narrow. The standard is twice as long as the calyx-lobes.

The pod contains only one seed, which, when ripe, is large and black in colour, and one of the most easily recognised of the common clover seeds. The burr contains from one to three seeds.

Figure B in the accompanying plate illustrates the successive stages from the opened upright flower (right) to the maturing burr (left). The habit of burying the fruiting burr has earned for the plant its specific and common name.

Subterranean Clover is a native of Southern and Western Europe, and North Africa.

BONE CHEWING AND TOXIC PARALYSIS OF CATTLE.

H. W. Bennetts, M.V.Sc.,

Veterinary Pathologist.

The pastures in many of our districts are naturally deficient in lime or phosphates.

Animals, and particularly milking cows, constantly require supplies of these minerals in order to remain healthy.

Cattle will attempt to make good their mineral requirements, when pastures are deficient, by chewing bones, which are very rich in the necessary elements.

If mineral deficiency is very marked, the animals' appetites become more and more "depraved" and all kinds of rubbish are eaten.

Now there is in some districts a germ (*Bacillus parabotulinus*) which occurs in the soil, and infects carcases of animals, cattle, sheep, rabbits, etc. It is found, and, by reason of its great resisting powers, may remain for considerable periods, in bones of dead animals.

This *Bacillus parabotulinus* produces a powerful toxin, or poison. When the bacilli and toxin are ingested (with bones or other parts of carcases which are infected by the germ), particularly by cattle, in a great majority of the cases fatal results ensue. Carcases of animals which have died from the disease are, of course, very dangerous.

The disease produced is known as "Toxic Bulbar Paralysis" or "Parabotulism."

In order that the disease be produced on a property, two factors are essential: (a) Mineral deficiency; (b) presence of *Bacillus parabotulinus*.

Symptoms.

Dairy cows particularly are affected (these animals require large quantites of minerals for milk secretion); young animals not often.

The symptoms produced are due to paralysis of certain portions of the nervous system by the toxin of the bacillus.

In typical cases the animals are unable, or able with difficulty, to masticate and swallow feed. In the early stages there is difficulty in drinking; later no feed or water is taken. There is excessive salivation, and sometimes protrusion of the tongue. The gait is more or less staggering (partial paralysis), and the animal is dull. Rumination is disturbed and finally suspended, and the faeces are scanty. Progressive weakness ensues, the animal lies down and can be got to rise only with difficulty or not at all. Eventually, in from two days to a week after symptoms are first noticed, the animal sinks into a state of coma and dies.

These characteristic symptoms are not always shown. In very acute cases death is sudden; and other cases may be of longer duration than described, the affected animals showing general unthriftiness, loss of condition, and a "cripply" gait.

The bone-chewing habit is constant in all cases.

Diagnosis.

A history of bone chewing, in addition to symptoms more or less as described, would indicate parabotulism. There are no characteristic post-mortem features.

Treatment.

Treatment is of little avail. Do not drench affected animals; the result would probably be fatal (inability to swallow)

Prevention.

Remove the causes:—

(a) Prevent mineral hunger by suppling adequate bone meal in the form of a lick: bone meal 4 parts, coarse salt 1 part.

(b) Top-dressing pastures with superphosphate will eventually have the same effect as (a).

(c) Remove carcases and old bones from paddocks which are carrying stock and bury deeply, or, preferably, burn them.

Department of Agriculture. Dairy Branch Exhibit, Royal Agricultural Show.

POTATO CHIPS.

G. N. Lowe,
Senior Potato Inspector.

WET BAG TREATMENT FOR CUT SEED.

With the planting of the summer crop drawing near, attention may again profitably be drawn to this simple treatment to ensure a proper germination from cut seed. For the information of new readers this consists of cutting large tubers into bags which have been previously thoroughly wetted, and allowing the "sets" to remain in the bags in the shade until the cut surface has properly calloused over—ordinarily about two to three days—and then planting in the usual way. The object of this is to induce a complete healing of the cut surface in order to prevent risk of rotting, which is common with cut seed otherwise in the summer. Where seed is well sprouted, petrol boxes, into which is placed a folded wet bag above and below the seed will obviate the damage to the sprout likely to occur should such be placed in bags.

Sprouted seed, which is generally used in the Great Southern areas, needs greater care in handling to preserve the original sprouts than that planted in the South-West areas where unsprouted seed is more the vogue.

Nicely sprouted "greened" seed is of course always desirable, and repays the extra care expended upon it.

The habit of planting small whole tubers or round seed as it is generally termed in the South-West dates back many years, undoubtedly because of the difficulty experienced in obtaining a proper germination in the high temperatures at the time of planting the summer crop. Large seed cut is invariably used in winter.

The use of large seed cut certainly has the tendency to maintain the yield in that the greater percentage of large tubers, it is reasonable to suppose, come from heavy-yielding plants. Just as surely may it be accepted that the small tubers come from the very type of plant which should be rigorously culled, namely, the poor yielder. A dairyman who expects to successfully stay in the business does not reserve his "cull" cows for breeders, nor should the potato grower any more follow such a principle by planting seed which *should be* "culls" properly, now that the wet bag treatment makes the use of large seed cut possible.

It is very satisfactory to know, however, from information received from various parts of the State that the wet bag method is being followed with excellent results.

Prevalence of "Mosaic."—In the crop just harvested in the South-West this trouble (usually called "Crinkly Leaf" by growers) has been far more noticeable than ever before, particularly in those portions of crops which were planted very early when wet and cold provide just the suitable conditions for its advance.

It appears to the writer that the only remedy for growers is to completely clear out their supplies of "Mosaic" infected seed, and obtain strains of Certified Seed from the Young's Siding area, where fortunately for the industry strains exist that are free from the disease.

South-Western growers who were fortunate enough to obtain such seed for the winter planting and refrained from planting excessively early, have had splendid returns of "Mosaic" free produce.

Apparently, the fact that high temperatures act against the trouble, is at least one reason why the certified Young's Siding strains, which are summer grown, are noted for their freedom from the disease.

Summer temperatures, however, also have the effect of "masking" it only, and for this reason growers in Benger Swamp, who are known by officers of the Potato Branch to persist in planting infested strains, must not expect inclusion in the Certified Seed Scheme, because the disease will surely appear in the next winter planting, and this will be the quickest way to ruin the scheme which has already accomplished so much good.

Another Grower's experience of Certified Seed.—Mr. John Hill, of Wagerup, was not until recently aware that such a thing as Certified Seed existed, but now is a firm believer in the value of such seed, and has been good enough to advise this Branch of the fact.

Potato crop at Wagerup, grown by Mr. J. Hill. To the left of the "finish" is Benger Certified Seed—to the right a local strain of seed from a 12 ton crop.

Mr. Hill purchased Certified Seed grown at Young's Siding, which he planted in a piece of high well-drained land on the 7th June, using at the rate of a ton per acre of potato manure showing eight per cent. potash.

Planted alongside was a local strain of seed treated with a similar quantity of the same fertiliser, but later dressed with sulphate of ammonia at the rate of 200 lbs. per acre when a few inches high.

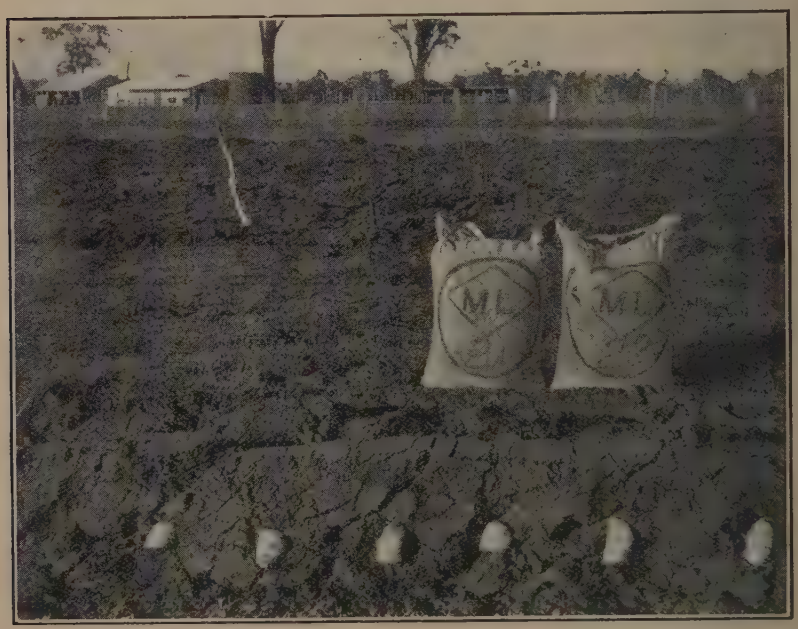
The Certified Seed returned at the rate of seven tons per acre; whilst the yield from those adjacent was only four tons, despite the top dressing.

Potatoes, at the time of digging, Mr. Hill states, were worth 25s. per cwt., but not one of his tubers from the Certified Seed would he dispose of, even at this figure, as he is retaining the whole of the yield for seed purposes.

In September, Mr. Hill planted a further area, the seed for which came from a 12-ton crop. Being rather short of seed he endeavoured to obtain sufficient Certified Seed grown at Young's Siding to complete the piece, but had to be satisfied with those from Benger Swamp.

The accompanying illustration (No. 1) depicts the two classes of seed in growth, those on the left being Certified Seed, to the right, the local strain.

The same experience is presented to the writer in his travels through the potato-growing areas wherever Certified Seed is properly treated.



"Sets" planted 4in. from the surface and 3in. up in the sod from the plow bed.

Depth of ploughing.—Numerous inquiries are to hand recently with reference to the depth of ploughing potato land, and briefly the correct depth may be described as the maximum at which the team will pull the implement. This does not, of course, imply that the seed should be planted at the same depth, as this would certainly be disastrous.

A very general practice in the district, with Brunswick as a centre, is to plough grass land in winter to a depth of four inches and merely drop the seed anywhere on the plough bed. This really asks too much of Providence, having regard to the fact that "heaven helps those who help themselves."

First and foremost, planting on the plough bed invites the risk of rotten "sets" in winter from lack of drainage, particularly where "lands" are wide and furrows not deep, and kept well open. Again, should the seed escape drowning, there is no well worked depth of soil in which moisture is conserved to carry on the crop, should a dry spell occur later in the growing period. The potato plant has not a vigorous root system, and responds to deep thorough cultivation as well as any plant grown.

Illustration No. 2 shows ploughing in grass land, seven inches in depth, with sets *placed* three inches up in the sod and four inches from the surface. This photo. was taken whilst the planting of a fertiliser experiment was in progress, and it was noticeable later that the germination in the plot was practically 100 per cent., whilst the surrounding crop planted under more or less "slapdash" methods with the sets dropped on the plough bed, was only 70 per cent. The difference in germination can certainly be attributed almost solely to the seed becoming water-logged when dropped on the plough-bed.

Shallow ploughing and planting, as described, certainly militates against ease and cleanliness of digging, owing to the shallow working of the implement being the prime cause of the cement-like condition of paddocks where this system is followed, particularly where the soil is at all stiff and grazed by numbers of stock when not in use for potato production.

At Harvey two partners in potato-growing are so seized of the importance of the deep-working of their potato land that, whenever possible, they actually subsoil, and are undoubtedly growing the heaviest crops in the district, although they are sticklers for thoroughness in all other phases of the business also.

GRAIN WEEVILS.

(*Calandra oryzae* and *Calandra granaria.*)

By L. J. Newman, F.E.S.,
Entomologist.

The protection of grain in storage from insect depredations is a serious problem to the farmer and to those dealing with this product in the stack, store or mill. It is unnecessary to descant on the enormity of the loss resulting from the existence of these destroying agents.

With this side of the question all dealers in cereal products are only too familiar. *The important* position to which this State has risen as a grain producer and exporter renders it imperative that every effort must be made to minimise the losses from storage insects. A *large portion* of the wheat produced is destined to be dispatched overseas; and when wheat contaminated by weevil, even to a moderate extent, is conveyed on a long sea journey, it is apt, if conditions are suitable to weevil development, to arrive at its destination seriously damaged and depreciated.

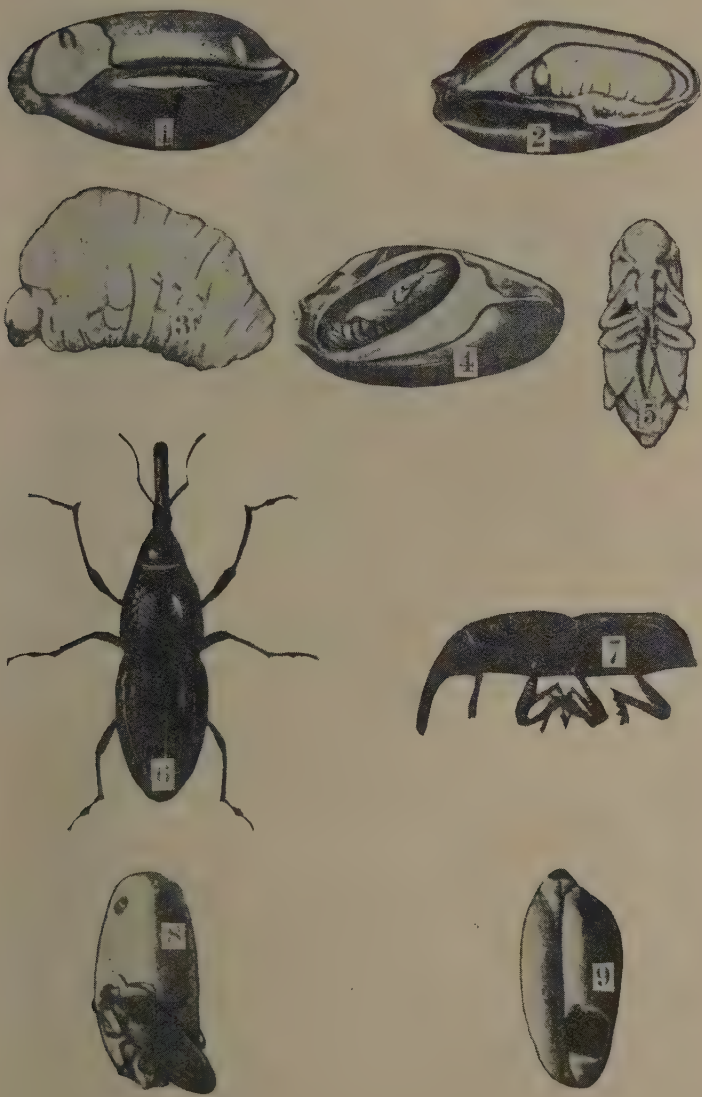
In the minds of many people even to-day there exists a belief, which is hard to kill, that weevil and wheat are inseparable. Some go so far as to claim that insects develop from the "Germ of grain" in some spontaneous way. These notions are entirely erroneous. *Every weevil* is derived from an egg laid by a female weevil. The females lay their eggs one by one to the number of several hundreds. By means of their mandibles small holes in the grains of wheat are made and an egg deposited in each hole. Usually only one egg is laid in each grain, as there is only sufficient sustenance in a grain to support one weevil. The laying period may extend over several months. The eggs are so small that to the untrained eye the wheat may appear perfectly free.

These eggs hatch into minute grubs or larvæ, which at once begin to feed on the substance of the grain, gradually enlarging the cavity made in the grain to accommodate their growing bodies. These larvæ are legless and are quite helpless if removed from the grain. When fully grown they pupate within the grain and finally cut their way out as adult weevils. This is really the first external evidence of infestation that is observed by the average grower or dealer and is what gives rise to the idea of spontaneous generation. The term weevil is the general appellation applied to all insects found in grain, without the knowledge and possibly without the interest to know, that grain is attacked by numerous destructive insects of widely differing orders and families, with entirely different habits.

The term weevil should only be applied to those beetles belonging to the Curculionidæ or snouted beetles. Most of the damage to wheat in this State is due to the Rice Weevil (*Calandra oryzae*) and to a lesser extent the Granary Weevil (*Calandra granaria*).

The former is winged and the latter wingless, but in other respects they are very alike in appearance, size and habits.

The climatic conditions of our coastal areas are favourable to the propagation of these weevils.



1. Eggs of weevil on wheat. *Enlarged.* 2. Larva of weevil feeding inside grain. *Enlarged.* 3. Naked legless weevil larva removed from grain. *Much enlarged.* 4. Pupa of weevil inside grain. *Enlarged.* 5. Naked pupa of weevil removed from grain. *Enlarged.* 6. Imago or adult weevil. *Much enlarged.* 7. Imago or adult, side view. *Much enlarged.* 8. Adult weevil gnawing into grain of wheat. *Enlarged.* 9. Grain of wheat showing exit hole made by escaping adult weevil.

There are no endemic Australian insects which seriously damage stored grain. The Rice and Granary Weevils are introduced pests. Such insects are readily diffused by commerce and are established in almost all grain growing countries. They are small snouted beetles belonging to the *Genus Calandridae*. The one most in evidence here is the Rice Weevil (*C. oryzae*).

Description: A dull, reddish brown beetle one-sixth to an eighth of an inch long. Head prolonged into a long snout or rostrum, at the end of which are the mandibles or jaws. The antennæ or feelers are elbowed and attached to the snout. The body is narrow, the thorax being densely pitted with round punctures. The abdomen is covered by the elytra or wing covers. The elytra are marked with four distinct rusty red to yellowish spots, two on each.

The flight wings are well developed but appear to be seldom used, the insect preferring to crawl from place to place. They are confined to stores, sheds, stacking sites, mills, etc. Upon being touched they have the usual weevil habit of feigning death and will lie still with their legs curled up for a considerable time, refusing, even when handled, to show any signs of life

Life History.

The Eggs.—These are oval, white bodies, and deposited in the grain. They hatch under normal summer conditions in three to five days. The *larvae or grubs*: They are white, wrinkled, fleshy, robust and legless with yellow-brown horny heads and biting jaws and live within the grain, feeding upon the starchy contents. This period lasts from twenty to thirty days.

Pupae.—When the larvæ are full grown they form their pupæ within the hollowed out grains. This quiescent stage lasts for three to five days. Finally the adult weevils emerge from the pupæ and cut their way out of the grains and are at once ready to breed and produce a new generation, to carry on the work of destruction.

In the case of these weevils, the adolescent or prewinged stages are spent within the kernels or grains. The Imagoes or adults exist entirely to reproduce their species and may live for a period of 12 months and lay many hundreds of eggs during this time. It will be seen that every 30 days in summer a complete life cycle from eggs to adults is accomplished.

It would therefore be possible for seven or eight generations to be hatched per annum, under our equable climatic conditions. In connection with this question of the multiplication of the weevil, it has been estimated that one pair of weevils may give rise to four to six thousand descendants in a single season. The damage done by the larvæ living on the substance of the grains is greatly added to by the adults which likewise feed upon the wheat.

This weevil is regarded as a native of India.

The Granary Weevil (C. granaria).

This weevil is very similar in habits and life history to the previously described one. It differs, however, in the following respects:—

1. Its flight wings have become aborted and useless.
2. The elytra or wing cases are of a uniform brown colour, without markings.

3. The punctures on the thorax are larger and not so close together and oblong.
4. It is somewhat larger.
5. It is a pest of considerably lesser importance.
6. It is of European origin.

The development of Weevil in wheat and the increase in numbers of Weevils.

The wheat when stripped and bagged in the field is free of weevil. To prove this fact, a series of wheat samples were collected from some thirty different areas. The wheat was taken straight from the strippers, bagged, and conveyed to the Entomological laboratory.

Varieties of hard and soft wheats were included. The samples were placed in jars with calico coverings. These were kept for several years without insects of any description making their appearance.

Several samples were moistened with water, to raise the moisture content of the grain, thus producing conditions favourable to weevil, should eggs or larvæ be present, but still with negative results.

It is, therefore, evident that the wheat when harvested under local conditions is free of insect life.

To become weevily it must come in contact with the pest after harvesting.

This may happen in several ways:—

1. Placing the grain in old bags, which have been weevil infested, or in stores, sheds or stacking sites where there are weevils.
2. Using infested material in the construction of the foundations of the stack, such as untreated old dunnage, sleepers, bagging, etc., which had been used for previous stacking and sheltering.
3. The introduction of bags of weevily wheat into a clean stack, store or building.

Weevils increase in wheat according to the moisture content of the grain.

It has been proved that when harvested wheat in our fields averages 7 to 8 per cent. of moisture. In tests made, it was demonstrated that with any less moisture content than 10 per cent., weevils were dormant and did not breed, but when more moisture was added they became active and rapidly increased. A temperature of 80 deg. F. without moisture proves fatal.

Methods of Control.—Prevention. Cleanliness will accomplish much towards the prevention of injury by weevils and other stored food insects. Dirt, rubbish, and refuse material from old stacking sites, barns, etc., should be destroyed by fire, as soon as possible after the season's wheat has been got rid of. If left about, it harbours the overwintering weevils, which are the progenitors of the summer swarms. All old dunnage should be treated with some known weevil destroyer, before being used for the new season's wheat. Avoid the use of old bags which have become already tenanted by weevils. Do not place season's new bags in shed or building known to be

infested by weevils. See that implements when taken into the field are free of all old grain, chaff, etc., which may have accumulated during the winter and spring, as this is a fruitful means of conveying weevil into the field and thus infesting the new wheat.

Keep the wheat from getting wet, and stored in as dry a position as possible. Wheat if stored in a dry climate and protected from the weather and from the absorption of moisture from the soil, will keep indefinitely without danger from weevil. The prevailing methods of storage are more or less favourable to the development of weevil, particularly if stored on the seaboard. There, even if the protection from rain is complete, the moist sea air freely penetrating the stored bags, the moisture absorbed by the grain soon reaches the point which favours the multiplication of the pest. If rain gets into stack, the wet grain should be removed and dried and re-bagged.

Where economically possible, all stacking floors should be of a firm nature and free of cracks and crevices, thus permitting of a thorough clean up of loose wheat.

Never leave bags of wheat in the paddocks resting on the bare ground or uncovered.

Newly harvested wheat should be kept separate from old grain of the previous season. Old wheat is very liable to contain weevil and if mixed with the new crop or if same is placed in proximity will almost inevitably infest it. It is in the interests of all concerned to keep each season's crop entirely separate.

Treatment.—All old sites, if they must be used, should be thoroughly cleaned, the surface soil removed to a depth of six inches and replaced by fresh soil or sand.

Old dunnage should not be used again unless treated thoroughly with boiling water and bluestone or thoroughly sprayed with crude oil. Kerol one part to 8 to 10 parts of water is also effective. The old sleepers may be dipped in a boiling bath of bitumen and crude oil or boiling tar or boiling water.

In the treatment of sleepers or dunnage from old stacking sites, the following mixture has been adopted by the Westralian Farmers, Ltd.

Fifty per cent. bitumen heated and mixed with 50 per cent. crude oil.

The bitumen is weighed, then broken up with an axe and placed in the dipping tank. Care must be taken to see that no water is present, as it causes the mixture to froth over and is dangerous.

The material is then brought to a temperature of 300 degrees F. When all lumps are dissolved and the temperature does not exceed 220 degrees F. the crude oil of an equal weight to the bitumen is steadily added, avoiding any splashing.

The mixture is then brought to a temperature of 350° F. and maintained at this heat, whilst the sleepers or dunnage are passed through the tank. On no account must the temperature be raised above 425° F. as this is the explosive point of the mixture.

A slow fire must be maintained all night, as if the mixture is allowed to cool down it takes a considerable time to again heat up.

At the termination of any treatment the bitumen and oil remaining should be drained off, and the residue at the bottom of the tank removed before it sets hard. If allowed to set like cement in tank, there is a great danger when reheating of burning out the bottom of the tank, with serious results.

The quantity remaining in the tank each day must be calculated and 2 per cent. of crude oil added to allow for the evaporation of volatile oils.

It is essential in carrying out this work to have reliable thermometers.

The weight of the D. X. bitumen is six casks to the ton—216 gallons of liquid bitumen. Crude oil weighs 9 lbs. to the gallon.

Old bags or bags suspected of or likely to harbour weevil should be dipped in boiling water to which a little bluestone has been added.

Any implements such as carts, wagons, strippers, etc., should be treated with boiling water.

To protect seed wheat from weevil has always been a farmer's difficulty.

It is advisable for farmers to hold a reserve of seed in case of loss by drought, hail or insect invasion of crop. Seed wheat may be treated with carbon-bi-sulphide, cyano gas or other methods. The effects are good, but give no permanent protection, the seed being again subject to invasion when the effects of the gases have gone off.

By accident it has been found that in the treatment of wheat with copper carbonate dust, as applied to prevent bunt or stinking smut, we have a perfect remedy against weevils and other grain-infesting pests.

Several experiments with this dust have been carried out proving its undoubted efficacy as an insecticide. Copper carbonate does not in any way injure stored grain, regardless of time stored. Unfortunately it cannot be used to protect wheat, other than seed wheat, as there is a danger from poisoning if wheat so dusted is fed to animals or humans.

The effect of this dust on weevils is first noted in their retarded movements. They become less and less active, until death ensues.

In the tests made no weevils lived longer than 10 days after treatment. W. W. Mackie, of California, states the following: "The action of the copper carbonate upon the insects is limited to its caustic effect. The softer, moister surfaces, especially in creases between the joints of the legs and other parts of the body, appear to be most affected by the chemical dust. No doubt a portion of the chemical salt goes into solution through the action of the solvents on the moist, soft surfaces of the insects. This chemical reaction eventually causes death. Undoubtedly minute particles of the dust enter the respiratory system of the insects."

By the discovery of the insecticidal properties of copper carbonate we now have a cheap, effective and easily applied remedy for the protection of seed wheat against insects.

The dust is applied to the wheat at the same rate as that used when dusting for smut, namely, 2 ozs. per bushel. By this treatment two purposes are accomplished, namely, protection to wheat from fungi, and insects.

Fumigators.

If the wheat is stored under conditions suited to the application of a gas, CS_2 or carbon-bi-sulphide is the fumigant mainly used. Its vapour is heavier than air and will penetrate cracks and crevices. It is a powerful insecticide, the atmosphere produced by its vapours being sure death to insects and vermin. It does not injure the food value of the grain, nor is its vitality impaired.

The quantities to be used depends on the size of the building, its tightness, and magnitude of the weevil attack. Generally speaking the dosage is from 1½ to 2 lbs. per 1,000 cub. ft. of space. If grain is in bins, use 1½ lbs. to every 100 bushels of grain.

To find the cubic contents of a building, multiply the length by the height by the width. Thus a room 10 ft. x 10 ft. x 10 ft. would equal 1,000 cubic feet of space.

The carbon-bi-sulphide should be poured into shallow dishes placed on top of the stack and left to evaporate, the operator promptly leaving the building and closing the doors.

The building should be kept under the gas for 48 hours. All windows and doors should be thrown wide open and the building allowed to air for at least two hours before anyone enters after fumigation.

A feature about this gas that must not be overlooked or forgotten is its inflammability and explosiveness. During the process of fumigation, therefore, all naked lights must be kept away, nor should the operator smoke. Carbon-bi-sulphide has a very disagreeable odour, and as the fumes are poisonous they should not be breathed, though a little will do no harm.

Hydrocyanic Acid Gas Treatment.

With the advent of the dust form of cyanide known as "Cyanogas," the old cumbersome and dangerous pot method was discarded. When this calcium cyanide dust is exposed to the air it slowly gives off hydrocyanic acid in the form of a gas. This gas is a most deadly insecticide. There are several grades of the dust, but that known as "A" fumigant, a very fine dust, gives the best results. Small tests with this material have been made locally, and there is little doubt as to its deadliness when applied to the weevils.

The dosage recommended is 25 lbs. of cyanogas dust per 1,000 bushels of wheat, or 1 oz. to 2½ bushels. This, to get the best results, should be mixed with the wheat. Good results, however, follow the application of the dust when forced, by means of a dust bellows, through the interspacing between the bags.

The building or stack so treated must be made gas-proof. If this is not possible, make allowance for the leakage by increasing the dosage. The period of exposure is 72 hours. The advantages of this treatment over the carbon-bi-sulphide are the following:—

1. All fire risk is removed, since it is non-inflammable and non-explosive under ordinary conditions.

2. It can be applied with success at as low a temperature as 40° F.

This dust does not act as a preventive, but, by the gas given off, destroys all living insects then present.

It can be used with perfect safety on grain from the milling, baking, feeding and germination points of view, as it has no deleterious effects whatever.

In its application care needs to be exercised to see that the dust is not inhaled. This can largely be avoided by keeping to windward or by wearing a mask.

Before entering a treated building see that same has been well ventilated. When necessary to clean out bins, allow air to circulate for 15 minutes before entering.

With ordinary care and intelligence there is little to fear from the handling and application of this handy and economical form of fumigation.

A HOME-MADE WINDMILL.

Geo. L. Sutton,

Director of Agriculture.

Home-made windmills are not common, and it is not intended to suggest that they should become so and replace the very efficient factory windmills which are now so readily obtainable and the small sizes of which can be purchased without the expenditure of a very large amount of cash. It is, however, conceivable that under certain circumstances information regarding the construction of a simple home-made mill will be useful; hence this description of such a windmill which was seen working on the farm of Messrs. Caw and Hubbe, "Woodenup," Kojonup, and who have very courteously supplied details of its construction.

A Home-made Windmill. "Woodenup," Kojonup.

The principal part of this mill, and from which the motive power is obtained, consists of a wheel with four blades or vanes, and constructed after the fashion of a paddle wheel. Each vane of this wheel is a sheet of galvanised roofing iron, 9 feet long, and is attached at its ends to the ends of

one of the members of each of a pair of crossarms, which are constructed to form a skeleton framework to support the vanes. Each crossarm consists of two pieces of 3in. by 2in. hardwood 12 feet long and bolted together on their flat at right angles to each other as shown at A, Fig. I. Each crossarm

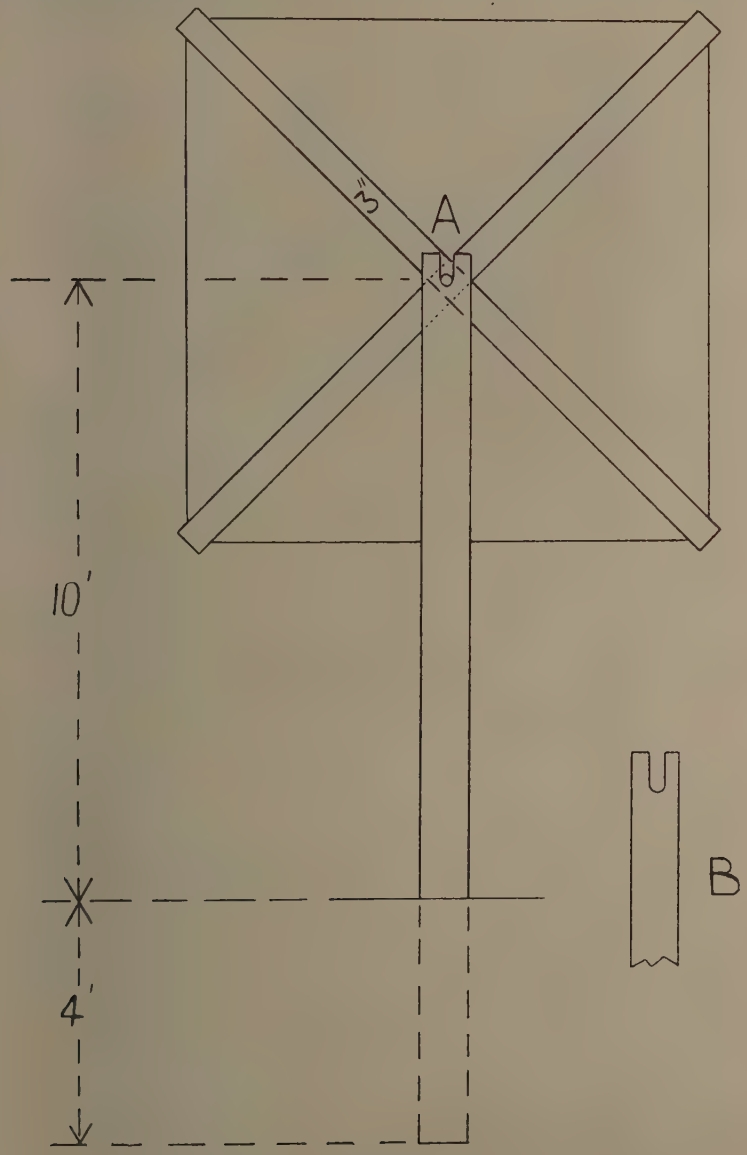


Fig. I.

is further strengthened by a wire brace secured to and strained around the ends as shown in the illustration referred to. These crossarms, with a space of 8 feet between them, are secured to a wooden centre piece. The wooden centre piece is made of two pieces of 3in. x 1½in. hardwood nearly 10 feet long, bolted together on the flat (Fig. II.). Each end of this centre piece is

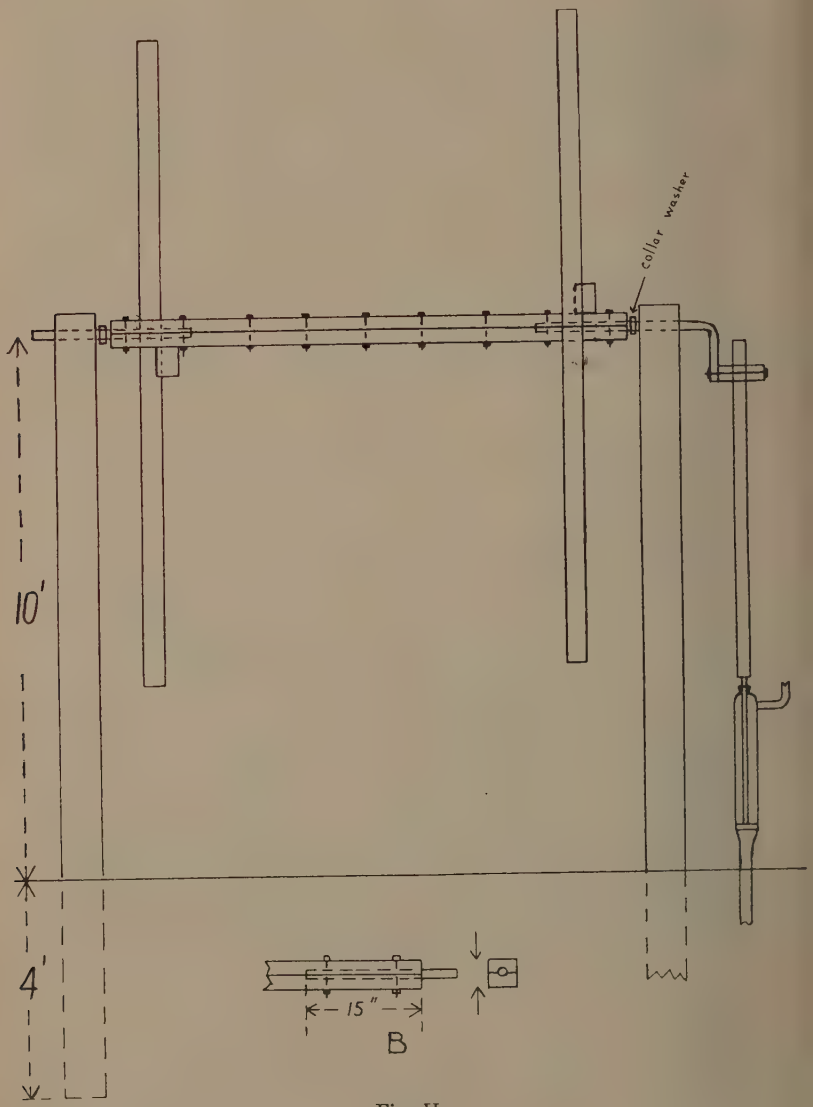


Fig. II.

bored out for about 15in. long in order to take pieces of ¾in. pipe, which act as spindle ends upon which the wheel revolves. The detailed construction of the end is shown at B, Fig. II. The bearings for these spindles are formed by boring holes to the required size near the top of a post, and about 10 feet from the ground. To facilitate the handling of the wheel, that portion of the post immediately above the centre of the auger hole is cut away, as shown at B, Fig. I.

In order to prevent the spindle rising out of this slot under severe strain, a small pin should be placed above it.

The crank, by means of which the necessary action is given to the pump rod, is made by bending the longer of the two pieces of pipe forming the spindle ends at right angles to the centre piece. The length of the bent piece depends upon the length of the pump stroke. In order to provide material in which to secure the bearing to the pump rod, it must exceed half the length of this by at least one inch, and preferably a little more. The end of the bent portion is flattened and bored to take a bolt which secures a short piece of 1¼in. pipe, filled with a wooden core, and which acts as a spindle to fit into the pump rod. This bottom spindle is parallel to the top spindle end, and is at right angles to the arm. The distance of the centre of the bottom spindle from the centre of the main spindle is just half that of the length of the pump stroke.

The construction of this crank is shown in Fig. III. Other methods of constructing a home-made crank will suggest themselves to settlers. For instance, in some cases it will be possible to bend a piece of 1in. round steel

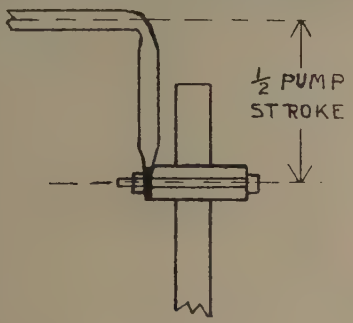
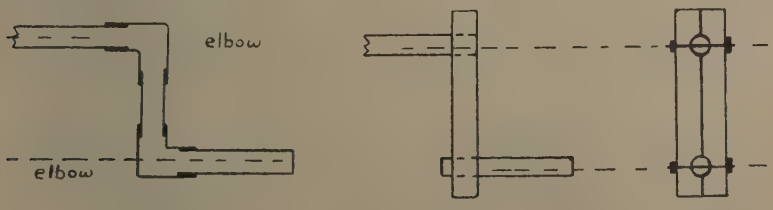


Fig. III.

in order to form the spindle end and crank in one piece. The crank may also be made by screwing piping together with "elbows," as shown at A, Fig. IV., or as at B, Fig. IV., where the crank arm is formed by a piece of



A B

Fig. IV.

3in. by 1in. or 3in. x 2in. hardwood bored to correspond with the outside diameter of the main spindle end and bolted together after being cut down the centre so as to enable a friction joint to be formed. The bottom spindle in this case consists of a ¾in. bolt with a long thread, so that it can be secured to the wooden part by means of a nut on each side.

It must be pointed out that this windmill works both ways, and therefore if the crank is made up of pipes and elbows these must be secured also by a pin to prevent unscrewing.

In order to derive the necessary power from the wind it is necessary that the vanes be given a wind or twist something after the fashion of a screw. The twist on the "Woodenup" mill is about 35°, and was increased to this angle—the maximum possible without reconstruction—after a lesser "twist" had been found to be insufficient. In order to get the maximum power it is suggested that the "twist" be 45°. The necessary "twist" is secured by the relative position which the members of the two crossarms bear to each other when mounted on the spindle. The crossarms are so mounted that, when viewed from the side, the different members of the two crossarms are not parallel to each other, and in order to secure a "twist" of 45° the members of the crossarm at one end of the spindle will be placed so that they are midway between the members of the crossarm at the other end. This arrangement can be seen from Fig. V., where the dotted lines

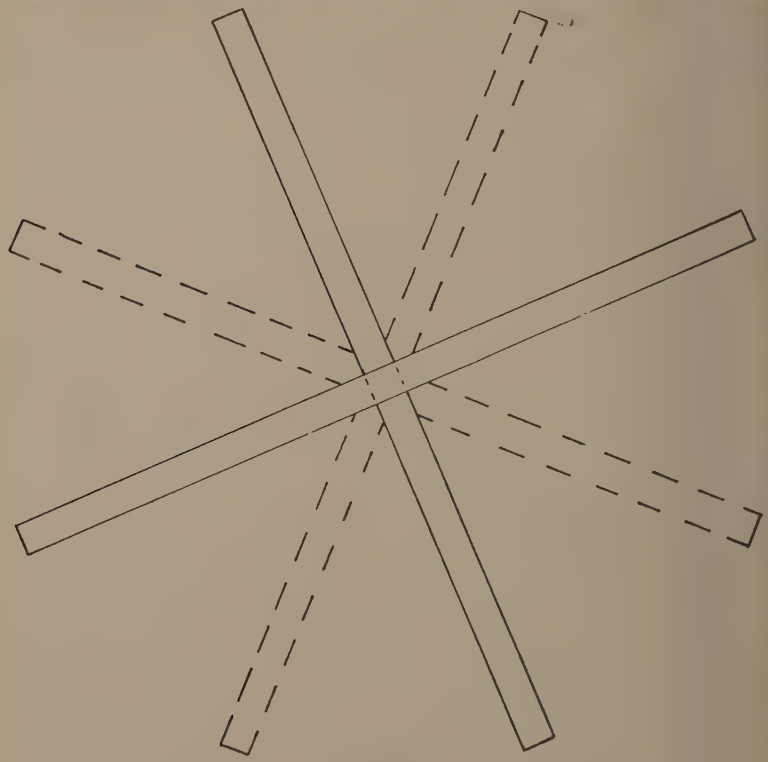
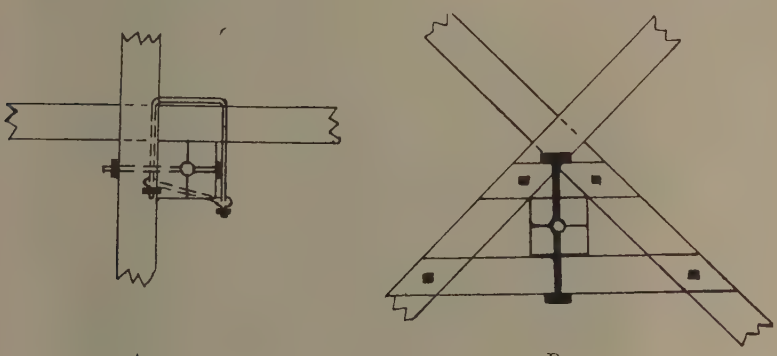


Fig. V.

..... represent the members of one crossarm, and the black lines ———— those of the other. One pair of crossarms is secured to the spindle by a ⅜in. bolt passing through it, and also by a ¾in. U bolt passing round the spindle and through the crossarm (Fig. VI. (A)). In order to give balance



A B

Fig. VI.

the other crossarm is secured to the opposite side of the spindle. This crossarm is rather more difficult to secure as, because of the "twist" given to the vanes, it does not sit flat on the wooden centre piece, but is at an angle of 45° to it. One method of securing the second crossarm is shown at B, Fig. VI. Two 3in. x 2in. slats are bolted, as shown, to two members of the crossarms, and the spindle is secured to these by means of a bolt passing through them and through the spindle. Experience has shown that the best wind is that which is in line with the spindle either way, and the worst that which blows at right angles to it; the windmill should, therefore, be erected so that its spindle is in line with the prevailing wind.

Department of Agriculture. Sheep and Wool [illegible] Royal Agricultural Show.

WOOL GROWING IN WESTERN AUSTRALIA.

H. McCallum,

Sheep and Wool Inspector.

The history of wool growing in Western Australia is brimful of human interest, and the story of the early pioneers who blazed the track in the great North-West stands as an epic. In spite of many obstacles this vast State is forging ahead, and to-day the position is sound and the future full of promise.

Our early breeders gave attention to improving the flock by selection, and every flock gave further thought for improvement. Importations of the best sheep from the Eastern States were used to build up our flocks, and after years of careful study the experience gained has resulted in our attaining such a position that buyers now come from all parts of the world to purchase our wool. Rams bred in the State have been shipped overseas. This is a tribute to the soil and climate of Western Australia and a good advertisement to the State as a merino producing country.

In these days of diminishing numbers of flocks in many parts of the world, it is satisfactory to see that in this State there is an increase in the numbers of sheep and the return of wool per head compared with that of a few years ago. The flocks on our wheat farms are yearly increasing and will continue to increase as improvements are made.

The breeding of fat lambs for local and export trade is making great progress.

The demand for breeding stock is keener than it has ever been in this State.

Our asset in sheep and wool is of great value and to what it is likely to increase within the next few years is hard to estimate, as no part of the Commonwealth to-day offers a greater return for capital invested than this State.

CAPE TULIP

(Homeria Spp.).

W. M. Carne, F.L.S., and C. A. Gardner.

Two species of Homeria, *H. collina* and *H. miniata*, locally known as Cape Tulip, are naturalised and troublesome weeds in certain localities in South-Western Australia. The former is sometimes distinguished as "one-leaved Cape Tulip" and the latter as "two-leaved," these being distinctive characters. The genus Homeria, which is native to the Cape Province of South Africa, has six species. *H. collina* appears to be there more or less confined to districts near the coast, while *H. miniata* extends inland to the central regions.

There is little doubt that, like several other South African plants, the Cape Tulips were introduced into Western Australia as ornamental plants, which in favourable spots have spread from gardens and become naturalised. The plants thrive in cleared places where there is a clay or heavy soil of an alluvial nature; they are rarely seen on the lighter sandy soils. The areas most affected by the weeds are near Beverley, York, Gingin, Bayswater and Guildford. At the last-named place the plants are known as the "Caversham Bulb."

The Cape Tulips are well adapted for spreading. In addition to the ordinary means of seed, the plants—especially *H. miniata*—produce numerous bulbils (little bulb-like organs) in their leaf-axils. These play a large part in the spread of the plants. Eradication is difficult on account of these bulbils. Pulling out and destroying the plants is the most effective means of disposing of them. Frequent cultivation in the winter months and harrowing may be expected to give results, but in badly affected areas complete eradication is an undertaking requiring much work and time.

The Cape Tulips are poison plants. Their toxicity has been demonstrated in cattle, and they are probably poisonous to all classes of stock. Fortunately cattle bred in a district where Cape Tulip is common appear to avoid the plant. Cattle from Tulip-free districts, when introduced into paddocks containing Cape Tulip often succumb after eating comparatively small amounts.

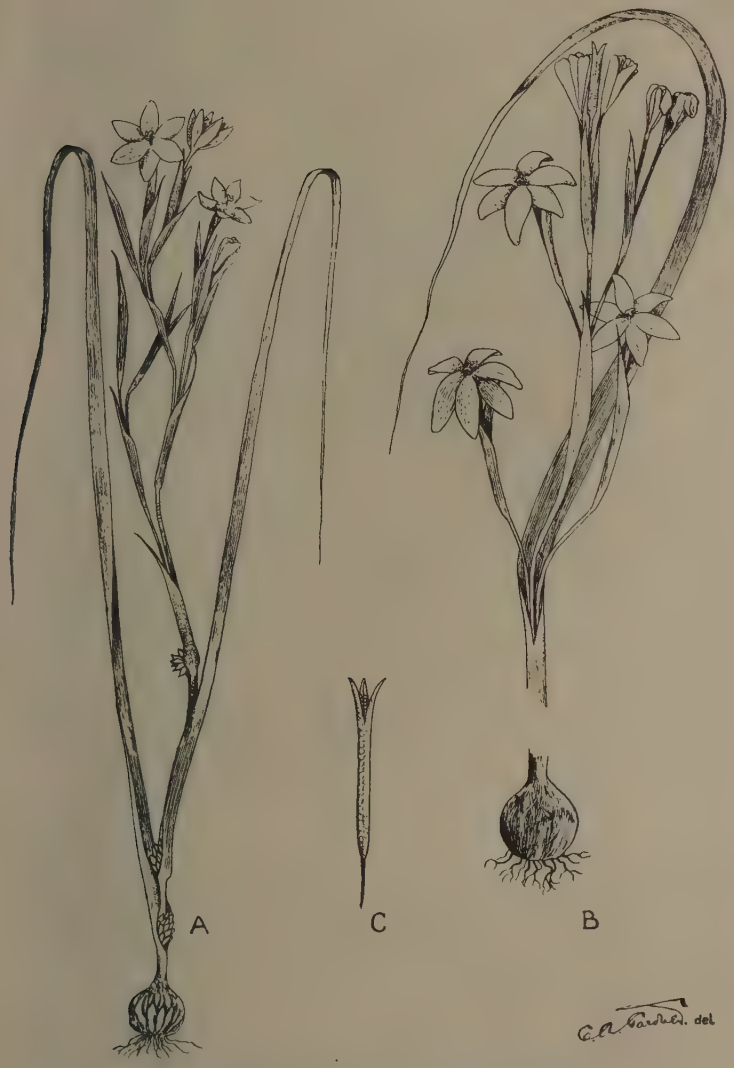
Description of Plants.

Flowers with a very short tube and 6 petal-like spreading almost equal segments; stamens 3; filaments of the anthers united in a tube; style with three short and broad branches. Capsule (seed vessel) long and cylindrical. Flowers individually stalked, each of the bract-like spathes containing 2 to 4 flowers. Leaves few, grass-like, usually ribbed, corm (the so-called bulb) covered with brown coats.

Homeria collina.—This plant possesses one leaf which is much longer than the flowering stems, and ribbed; flowers red or pink with a green or yellow base, or sometimes all yellow, up to 1¼in. diameter.

Homeria miniata.—Usually a smaller plant than *H. collina*, possessing two or three leaves with bulbils in their axils and around the corm. Flowers salmon pink, the yellow base blotched with green, rarely 1in. in diameter.

For further particulars see Plate.



A. Homeria miniata. Two-leaved Cape Tulip.
B. & C. Homeria collina (C. capsule). One-leaved Cape Tulip.

THE FOX IN WESTERN AUSTRALIA.

C. J. Craig.

Foxes have certainly increased rapidly during the past two years, and several have been killed within a few miles of Perth. No scalps have been received from the Far North, but from Northampton throughout the wheat country to Mount Barker and Albany they are unfortunately fairly common, and the sheep owner and the poultry fancier have another enemy to combat. Only lately they have been noted as giving trouble in stud paddocks in New South Wales, despite the fact that a seven-foot netting fence had to be climbed; but unless the netting is turned outward at the top at a sharp angle, the fox has no difficulty in entering, as he is even a better fencer than the dingo. Although the fox still forms a subject for heated argument as to whether it does more good than harm, I find that wherever I travel once the numbers have increased there is much more talk about the harm than the good. A fox put up in the open will, after a few twists and turns, head in a direct line for some definite refuge. Once settled on that course, unless turned temporarily by dogs, it will keep going at full stretch. Foxes kill poultry quite as much by frightening them as by any other means. Where they are roosting on a tree, the fox will run round and round the tree, especially on a moonlight night, until, sooner or later, as though mesmerised, one of the fowls will drop on to the ground, to be speedily snapped up by the fox. Foxes are apparently varied in temperament and intelligence; they occasionally do things which are quite foreign to their reputed habits; they have removed the tongues from lambs which have been brought up for safety's sake within a few yards of the homestead, in preference to young turkeys and young chickens which were more easily obtainable. Where young rabbits could have been taken direct from the nest by scratching a few inches of soil away, they have continued to wilfully maim and kill lambs enclosed within a high netting fence, to climb which involved much effort. The day is past for giving the fox the benefit of the doubt. If some prefer young rabbits to young lambs, that does not prove that all of them do. It is only a matter of time and education for the fox to develop an appetite for the more costly victim. The cunning of the fox has long been proverbial, and in consequence it was supposed that the method of its extermination would severely tax human ingenuity. With the example in the background of the dingo, and of the craft with which that animal could successfully dodge traps and refrain from swallowing poison baits, it was supposed that some better means of destroying foxes than by trapping and poisoning would have to be devised. It has, however, been learned that either or both of those means can prove highly destructive. The administering of poison is easy, and the result effective by reason of the simplicity of the process, as well as in this connection of the simplicity of the fox itself. However high a standard the cunning of the fox may have traditionally attained in all other directions, in the matter of devouring poisoned baits its reputation suffers greatly. Recognising that the fox no longer has any friends, with the exception of hunt clubs, and that even the novelty of his appearance has worn off, one does not hesitate to place before readers the views of several pastoralists. These men have unanimously declared in favour of poisoning with strychnine, and, though differing in minor details as to the best means of

administering this poison, they agree upon all main issues: the need for concerted action and the importance of delivering attack before and during lambing time. Where opinion seemed to vary most is on the subject of handling baits, and thus making manifest to the delicate nose of the fox some connection between human beings and these lures to destruction. The scent left by the touch of a hand to a bait, or by a tread of a foot around the locality, is considered fatal to success. By others, on the contrary, this part of the subject is treated lightly; they argue that so long as the baits are not unnecessarily handled, the scent speedily wears off. As baits, kidney fat, scraps of liver and kidneys find favour, and all kinds of dead birds are specially effective, the poison being inserted in the mouth by opening the beak. This last-mentioned form of bait is not removed by crows or other birds, and will tempt a fox even when dried up. The poisoning of ridges which foxes frequent for the purpose of having a look round, and along the edge of scrub and thickets which form their retreat and wherein they rear their young, and the dragging of some trail such as a sheep paunch, and dropping baits at intervals along the course taken, are points to be duly emphasised. The finding of a dead lamb with tongue missing and tail off declares the existence of a fox somewhere in the vicinity. A dead lamb thus discovered should be poisoned, for the fox will return later on, probably the same or following evening. Any partially eaten carcase should be treated with poison by making cuts in the flesh. Foxes are said to be shy of a sheep that has been skinned, but there can be no doubt that their courage is a rising or receding quantity in proportion to the cravings of hunger or the needs of a litter of cubs. They have been seen to run down a ewe and to set to work at once to devour her, and they have also been seen to be defeated by a ewe defending her lambs. They have been watched in the act of romping among young lambs as well as savagely attacking numbers of them one after another.

BACON MAKING.

P. G. Hampshire,

Superintendent of Dairying.

These notes are intended as a guide to the settler who desires to make bacon on his farm, and the first essential thing to observe is that all pigs for killing are in perfect health, otherwise they will never make good bacon.

The best class of bacon is only obtained from young pigs ranging from six to eight months old and weighing from 140 to 180 lbs., live weight, which is equal to 105 to 135 lbs., dead weight.

Before killing, pigs should be without food and remain quiet for 24 hours, while they should have access to plenty of clean water.

The pig should first be stunned, and then "stuck" by inserting a long knife in the pig's throat, immediately in front of the breast bone, with the point towards the tail. This severs the arteries on both sides.

The pig should be well bled. The scalding vat should be three parts filled with hot water, the temperature of which should be from 165 to 175 degrees Fah.

The carcase should be immersed and kept moving. After soaking the pig should be lifted and scraped. When scraping, start with the head and feet. See that the nose, ears, and feet are made sweet and clean. Hot water may be used while scraping is taking place. When all clean, the pig is hung up, cut open and intestines removed. When the pig is cool it should be laid on a table and cut up: the head being first removed. A deep cut is made with the knife along the back, close to the bone, from tail to poll. Saw the ribs from each side of the backbone. Lay the sides flat and remove leaf lard, kidney, etc.

If it is not desired to cure the whole side in one piece, the shoulder and ham should be cut off.

Curing.—The temperature of the curing room should, if possible, be kept down to 60 deg. Fah.

For dry curing the following recipe is recommended:—Fine dry salt, 50 lbs.; brown sugar, 5 lbs.; saltpetre, 2 lbs.

For the first three or four days this mixture should be rubbed in over the flesh parts and around the bones and joints. The sides should be stacked and the position changed each day. The time required for curing will be about 14 days. Continuous hard rubbing results in a hard cured flesh.

Pickling.—For pickling the following is a good recipe:—Clean rain water, 20 gallons; fine dry salt, 50 lbs.; brown sugar, 5 lbs.; saltpetre, 2 lbs.; allspice, ½ lb.

Dissolve the salt, sugar and saltpetre in the water, then put in allspice, tied up in a calico bag; boil for one hour and skim. If frothy matter rises on the surface whilst boiling it should be skimmed off. Allow the solution to cool before use. The above quantities are sufficient for 500 lbs. of meat.

The sides should be rubbed with salt for two days before being immersed in the pickle. After dry salting or pickling the flesh is brushed to remove pieces of salt, fat, etc., and then washed in rain water, and soaked in a solution of bi-carbonate of soda for 24 hours. (The solution is made by dissolving 1 lb. of bi-carbonate of soda in 20 gallons of clean rain water). After this, wash in clean rain water.

Hang up in an exposed, dry place, until the bacon is thoroughly dry, then remove to smoke-house and smoke to suit taste, after which, finish the sides by dressing and rubbing the skin with pure olive oil.

ROYAL AGRICULTURAL SOCIETY OF NEW SOUTH WALES CHAMPION PRIZES FOR 1928 ROYAL SHOW.

We have received a communication from the Secretary of the Royal Agricultural Society of Western Australia, advising that the Society in New South Wales is offering the following champion prizes for the 1928 Royal Show:—

Wheat, strong white, one bushel, open to growers throughout Australia of 100 acres or more grain. Samples submitted to be from an area of not less than 50 acres of same variety. Entry fee members and non-members 5s.

Commonwealth Champion Prize (Special Prize) £10, and Silver Cup value £25.

Wheat, medium strong white, one bushel, open to growers throughout Australia of 100 acres or more for grain. Samples submitted to be from an area of not less than 50 acres of same variety. Entry fee members and non-members 5s.

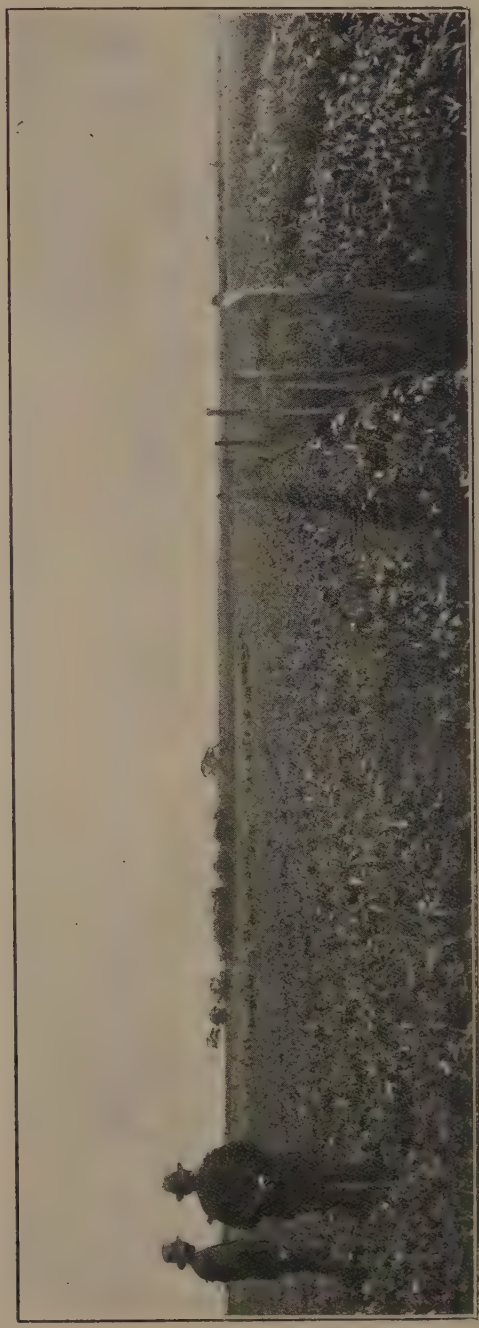
Commonwealth Champion Prize (Special Prize) £10, and Silver Cup value £25.

In forwarding this information the Secretary of the Western Australia R.A.S., Mr. W. J. Ashtoun, states that his Committee would be pleased to have the co-operation of the Director of Agriculture and his officers in placing these prizes before the wheat growers of this State, and assistance in forwarding exhibits to Sydney should our growers decide to compete.

The following varieties are recommended to intending competitors in this State:—

Strong White.—Comeback, Carrabin, Bobs, Minister.

Medium Strong White.—Yandilla King, Major, Marshall No. 3, Nabawa, Niloc, Hard Federation, Canberra, Gluyas Early, Merredin, Gresley, Florence.



Sheep on rape, Merredin Experiment Farm. Photo. taken by Mr. MacCallum Smith.

MURESK AGRICULTURAL COLLEGE.

EGG-LAYING COMPETITION, 1927-28.

S. FROOME, Poultry-keeper.

Week by week for the past six months—April 10th to October 9th—the records of the Muresk Egg-laying Competition have been published. The method of scoring is well understood by the majority of people interested in the competition, but may not be quite clear to others. In the system of evaluation the Committee controlling the competition has made a departure from the ordinary routine of Egg-laying Competitions, which in its incidence may be considered drastic. It is certainly a step that challenges notice. In the Muresk Competition a final record is not in terms of eggs laid, but in terms of points or units gained. The unit is the 2oz. egg. Any egg below that weight is penalised. It has to suffer a loss of one quarter of a unit. Should it weigh less than 1½ozs. it is recorded but receives no credit at all. To give concrete instances: a hen that laid 100 eggs 2ozs. or over in weight, would receive 100 points in the competition; a hen that laid 100 eggs weighing between 1½ozs. and 2ozs. would score 75 points; a hen that laid 100 eggs less than 1½ozs. would score no points at all.

The penalty of a 25 per cent. loss is purely dogmatic. Some might desire a heavier penalty, some a lighter penalty. It is immaterial as far as the competition goes, for all birds are on the same footing.

The question may arise in the minds of some, "Why penalise in this fashion?" The answer to that question is really the raison d'etre of the Egg-laying Competition.

The poultry industry in Western Australia is on the eve of a big development. Poultrymen have been for some time past actively organising for the betterment of the industry. In times past the industry has been precarious. The only possible market, the local market, was unstable. An export trade has been established which promises to change all this uncertainty. It will be a potent factor in the stabilisation of the industry. Now the success of our export activities will depend absolutely on the quality of the article we export. There is no place for us in the export trade as far as light weight eggs are concerned. It is not possible for us to compete in this direction against the European exporters with their cheap labour and proximity to the Old Country. But there is an unlimited market for the standard weight egg, and one of the finest things that has happened to the industry in Australia is the regulation which makes the 2oz egg the standard egg for export. If this regulation is strictly enforced—and it is being enforced in Western Australia—the Australian egg will take a place in the world's market, compatible with that gained by Australian merino wool and Australian wheat.

The time is very close at hand when local vendors of eggs will be required to sell them as up to or below standard weight. A person who went to the butcher's to buy 2lbs. of steak and found when he returned home that he had been given 1¾lbs. would be up in arms. But the same person would be quite content to buy a dozen eggs which would average 1½ozs.

and pay the same price which he would for a dozen which averaged 2ozs. He would make no fuss whatsoever. But the public is waking up to the fact that although "eggs is eggs" there can be a very great difference in the food value of eggs. The figures that follow are the record of the competition at the end of six months. They will be of very particular interest to the competitors, for the doings of each bird is recorded. The main interest, both to the breeder and the general public, however, will be in the comparison of the number of units gained by each bird, with the actual number of eggs laid. It will be seen that some birds in terms of the number of eggs laid would have put up a very fine record, but many of their eggs would have been useless for export as well as for breeding purposes. The aim of the competition is to raise the standard of the breeds of Western Australia, and the table here presented should carry its story to the mind of every breeder.

EGG LAYING COMPETITION.

Section "A."—Light Breeds.

Bird No.	1st Grade.	2nd Grade.	Total Eggs.	Total Units.	Totals for Group of three Birds.	
					Eggs.	Units.
1	109	4	113	112	...	...
2	67	...	67	67	...	...
3	126	5	131	129¾	311	308¾
4	91	10	101	98½	...	...
5	111	3	114	113¼	...	...
6	60	57	117	102¾	332	314½
7	127	4	131	130	...	...
8	65	68	133	116	...	...
9	89	2	91	90½	355	336½
10	68	70	138	120½	...	...
11	81	19	100	95¼	...	...
12	80	5	85	83¾	323	299½
13	27	88	115	93	...	...
14	90	34	124	115½	...	...
15	82	45	127	115¾	366	324¼
16	105	...	105	105	...	...
17	87	...	87	87	...	...
18	73	16	89	85	281	277
22	101	1	102	101¾	...	...
23	80	2	82	81½	...	...
24	105	2	107	106½	291	289¾
25	98	31	129	121¼	...	...
26	91	6	97	95½	...	...
27	66	30	96	88½	322	305¼
28	97	35	132	123¼	...	...
29	126	...	126	126	...	...
30	59	56	115	101	373	350¼
31	31	...	31	31	...	...
32	113	...	113	113	...	...
33	76	...	76	76	220	220
34	62	71	133	115¼	...	...
35	25	98	123	98½	...	...
36	136	3	139	138¼	395	352
37	109	15	124	120¼	...	...
38	100	3	103	102¼	...	...

EGG LAYING COMPETITION—*continued.*

SECTION "A."—*continued.*

Bird No.	1st Grade.	2nd Grade.	Total Eggs.	Total Units.	Totals for Group of three Birds.	
					Eggs.	Units.
39	125	4	129	128	356	350½
40	98	6	104	102½	...	...
41	98	15	113	109¼	...	...
42	3	114	117	88½	334	300¼
43	118	1	119	118¾	...	...
44	68	4	72	71	...	...
45	50	53	103	89¾	294	279½
46	101	6	107	105½	...	...
47	85	10	95	92½	...	...
48	99	10	109	106½	311	304½
49	49	...	49	49	...	...
50	110	...	110	110	...	...
51	112	3	115	114¼	274	273¼
52	15	53	68	54¾	...	...
53	24	42	66	55½	...	...
54	40	79	119	99¼	253	209½
55	90	...	90	90	...	...
56	70	2	72	71½	...	...
57	104	...	104	104	266	265½
58	82	2	84	83½	...	...
59	120	2	122	121½	...	...
60	116	2	118	117½	324	322½
61	110	5	115	113¾	...	...
62	98	20	118	113	...	...
63	33	33	66	57¾	299	284½
64	44	58	102	87½	...	...
65	88	13	101	97¾	...	...
66	105	1	106	105¾	309	291
67	117	1	118	117¾	...	...
68	91	40	131	121	...	...
69	113	...	113	113	362	351¾
70	115	...	115	115	...	...
71	117	...	117	117	...	...
72	95	...	95	95	327	327
73	44	74	118	98	...	...
74	59	26	85	78½	...	...
75	52	3	55	54¼	258	230¾
			SECTION "B."—HEAVY BREEDS.			
1	85	28	113	106	...	...
2	59	86	145	123½	...	...
3	136	10	146	143½	404	373
4	34	52	86	73	...	...
5	114	14	128	124½	...	...
6	91	3	94	93¼	308	290¾
7	54	11	65	62¼	...	...
8	53	28	81	74	...	...
9	94	58	152	137½	298	273¾
10	125	1	126	125¾	...	...
11	53	88	141	119	...	...
12	132	8	140	138	407	382¾
13	114	2	116	115½	...	...
14	9	136	145	111	...	...

EGG LAYING COMPETITION—*continued.*

SECTION "B."—*continued.*

Bird No.	1st Grade.	2nd Grade.	Total Eggs.	Total Units.	Totals for Group of three Birds.	
					Eggs.	Units.
15	21	86	107	85½	368	312
16	82	53	135	121¾	...	...
17	111	17	128	123¾	...	...
18	112	1	113	112¾	376	358¼
19	92	1	93	92¾	...	...
20	108	1	109	108¾	...	...
21	86	2	88	87½	290	289
22	143	8	151	149	...	...
23	140	16	156	152	...	...
24	141	3	144	143¼	451	444¼
25	45	91	136	113¼	...	...
26	31	69	100	82¾	...	...
27	20	123	143	112¼	379	308¼
28	88	...	88	88	...	...
29	94	31	125	117½	...	...
30	117	1	118	117¾	331	323
31	67	72	139	121	...	...
32	48	93	141	117¾	...	...
33	111	12	123	120	403	358¾
34	35	119	154	124½	...	...
35	128	1	129	128¾	...	...
36	113	1	114	113¾	397	366¾
37	133	5	138	136¾	...	...
38	67	44	111	100	...	...
39	12	133	145	111¾	394	348½
40	119	20	139	134	...	...
41	60	76	136	117	...	...
42	122	...	122	122	397	373
43	130	8	138	136	...	...
44	86	21	107	101¾	...	...
45	112	1	113	112¾	358	315½
46	132	13	145	141¾	...	...
47	129	2	131	130½	...	...
48	97	16	113	109	389	381¼
49	61	16	77	73	...	...
50	49	74	123	104½	...	...
51	93	7	100	98¼	300	275¾
52	121	2	123	122½	...	...
53	80	...	80	80	...	...
54	135	...	135	135	338	337½
55	84	36	120	111	...	...
56	122	...	122	122	...	...
57	112	3	115	114¼	357	347¼
58	75	...	75	75	...	...
59	140	1	141	140¾	...	...
60	111	9	120	117¾	336	333½
61	105	14	119	115½	...	...
62	104	5	109	107¾	...	...
63	101	3	104	103¼	332	326½
64	115	3	118	117¼	...	...
65	103	3	106	105¼	...	...
66	86	1	87	86¾	311	309¼
67	44	100	144	119	...	...
68	79	73	152	133¾	...	...

EGG LAYING COMPETITION—*continued.*

Section "B"—*continued.*

Bird No.	1st Grade.	2nd Grade.	Total Eggs.	Total Units.	Totals for Group of three Birds.	
					Eggs.	Units.
69	61	73	134	115¾	430	368½
70	115	6	121	119½	...	...
71	87	44	131	120	...	...
72	112	35	147	138¼	399	377¾
73	120	...	120	120	...	...
74	65	49	109	98	...	...
75	115	7	122	120¼	351	338¼
76	87	61	148	132¾	...	...
77	50	67	117	100¼	...	...
78	114	...	114	114	379	347
79	113	32	145	137	...	...
80	20	83	103	82¼	...	...
81	82	59	141	126¼	389	345½
82	84	38	122	112½	...	...
83	54	109	163	135¾	...	...
84	73	69	142	124¾	427	373
85	21	93	114	90¾	...	...
86	30	102	132	106½	...	...
87	103	15	118	114¼	364	311½

Monthly Test Averages.

Month.	April.*	May.	June.	July.	August.	Sept.
Light breeds ...	10·11	15·75	14·44	16·19	19·88	21·77
Heavy breeds ...	10·22	18·95	20·73	20·72	22·33	22·59
Average for Competition	10·16	17·35	17·58	18·45	21·10	22·18

* From 10th to 30th April, inclusive.

Western Australian Rams for South Africa, bred at the "Tootra" Stud, near Moora.
(Block kindly supplied by "Dalgety's Review.")

TREATMENT OF SHEEP ON THE FARM.

Hugh McCallum,
Sheep and Wool Inspector.

It is often forgotten by many farmers that the stock-carrying capacity of the farm is determined by the extent of its ability to carry stock at the period at which feed is scarce. Farmers generally are too anxious that feed should not "go to waste." They would be acting wisely, and pursuing a sound business policy, to have a reserve of feed on hand, over-stocking or under-providing being amongst the greatest evils on the farms to-day. The growing of oats and various fodders is a necessity for feeding the sheep in the summer and autumn. Where farmers have fed early, before the sheep were allowed to get in low condition, a good percentage of lambs has been the result, compared with those who failed to feed their flocks prior to the break-up of the dry weather. I trust that the farmers will have no losses, through neglect to provide ample feed reserves, during the coming year.

The doctrine of having a reserve of feed on hand has been preached year in and year out; yet there are many farmers who depend too much on nature and not enough on their own energy to provide for the dry period of the year. Many owners continue to have losses every year; why, it is hard to understand. They pay dearly, indirectly, for losses on stock. When they do decide to feed their sheep it is usually when the animals are in too low a condition to derive any benefit from same. There is no sight more distressing than that of sheep in a paddock wasting away for want of sufficient food. Sheep farming on such a system can yield neither profit nor satisfaction. The farmer gets rid of his sheep at any price, convinced that sheep husbandry and wheat growing cannot be carried on together with profit. With such bad examples before them, many wheat farmers are perhaps hindered from keeping sheep. Sheep on the wheat farms are increasing yearly, and add considerably to our national wealth.

CHRISTMAS AND NEW YEAR—COOKERY; ALSO CHRISTMAS FAVOURS.

By Miss M. A. Wylie,

Inspectress and Organiser, Domestic Science Classes, Education Department.

Christmas Pudding

1 lb. flour, 1 lb. bread crumbs, 1 lb. beef suet, 1 lb. brown sugar, ¾ lb. sultanas, 2 lbs. raisins, ½ lb. mixed peel, 1 lb. currants, 6 eggs, 1 gill brandy, 2 chopped apples, ¼ lb. chopped almonds, grated rind of 2 lemons, juice of one lemon, 1 teaspoon mixed spice, 1 teaspoon cinnamon, 1 grated nutmeg, 1 teaspoon crushed cloves, 1 teaspoon salt, half teaspoon carbonate soda, 1 glass stout.

1. Prepare and mix fruit. 2. Add remaining dry ingredients (excepting soda). 3. Add eggs and brandy and mix some of dry ingredients, then heat stout and add soda to it and add to the mixture. 4. Mix thoroughly and heat for a few minutes. 5. Pack in greased moulds, cover with scalded floured cloths; boil 6 to 8 hours. 6. Keep puddings in cool place several weeks before using them, and reboil for several hours as required. Before serving pour a wine-glassful of brandy round basin and over pudding, and light just before taking to table.

Plum Pudding.

Two cups of flour, 1 cup bread crumbs, 1 cup sugar, 1 cup raisins, 1 cup currants, half-cup lemon peel, half-packet spice, half-teaspoon cinnamon, half a nutmeg, 1 tablespoon beef dripping, 1 tablespoon butter, 1½ cups boiling water, 1 teaspoon carbonate soda.

Method.—1. Sift flour; add bread crumbs, sugar, spices and fruits. 2. Mix dripping, butter, soda, and boiling water in separate basin, and add to the dry ingredients immediately. 3. Boil in scalded and floured cloth 6 hours. 4. Serve hot with sauce.

Roast Duck

One duck, sage and onion stuffing, salt, pepper, dripping, apples.

1. Prepare duck, draw, and singe. 2. Rub with salt inside and out. 3. Fill with stuffing, and sew up opening; truss. 4. Wrap bird in greased paper and cook in hot oven with dripping for 10 minutes: cooler oven, 1½ to 2 hours, according to size of duck. Baste frequently. 5. Ten minutes before dishing remove paper from duck, dredge with flour, and leave in oven to brown. 6. Serve hot with baked potatoes, brown gravy, and apple sauce or red currant jelly.

Note.—Duck may be stuffed with just apples and prunes if so desired.

Roast Turkey.

One turkey, veal stuffing or sausage meat, bread sauce, rolls of bacon or sausage.

1. Prepare bird, fill with stuffing, and sew opening. 2. Wrap in greased paper; place in baking tin with plenty of dripping, and roast in a hot oven ten minutes, then in a cooler oven for remainder of time (20 minutes to lb., 20 minutes over). 3. Baste frequently. 4. Remove paper and brown bird a few minutes before dishing. 5. Serve hot with good brown gravy and bread sauce.

Siberian Cream.

Ingredients.—1 quart milk (fresh), 2 ozs. gelatine, 1 cup sugar, 4 eggs, essence of vanilla.

Method.—Soak gelatine in some of the milk for half an hour; heat the remainder of the milk, add to it the gelatine; stir over fire; boil one minute; cool for a little; add yolks of eggs beaten with the sugar; then stir till boiling again; cool a little again and stir in the whites of eggs. Pour into a wetted mould, and when cold turn out on to a glass dish.

Christmas Cake (Rich).

Ingredients.—1 lb. butter, 1 lb. currants, 1 lb. raisins, 10 eggs, 2 ozs lemon peel, ½ nutmeg, 1 teaspoonful cinnamon, 1 lb. sugar, 1 lb. sultanas, ¼ lb. Jordan almonds, 2 ozs. orange peel, 4 ozs. citron peel, 1 teaspoonful ground ginger, 1¼ lbs. flour (15 ozs. plain, 1 oz. self-raising), 1 teaspoonful crushed cloves, 1 teaspoonful each of lemon, almond, or vanilla essence, ½ wineglass brandy.

Method.—1. Prepare fruit; blanch and chop almonds; shred peel. 2. Line cake tins with paper (3 or 4 layers). 3. Cream, butter, and sugar well. 4. Add eggs one at a time, beating well between each. 5. Add fruit and essences. 6. Sift in flour and spice; mix well. 7. Add brandy. 8. Two-thirds fill cake tin, scooping hole in centre of cake. 9. Put into moderately hot oven, and then gradually decrease heat. If mixture be made into one cake, it will take five or six hours to bake; two cakes will take three or four hours. 10. Test centre of cake with skewer. When cake is done skewer will come out clean.

Shortbread.

Ingredients.—12 ozs. plain flour, 4 ozs. ground rice, salt, 8 ozs. butter, 4 ozs. castor sugar.

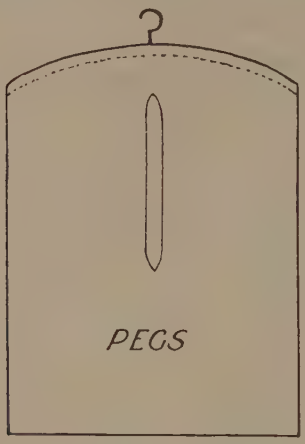
Method.—1. Sift flour, ground rice, and salt on to a pastry-board. 2. Knead the butter and sugar in a basin and turn on to the board. 3. Gradually knead in the flour. 4. Roll out and prick. Cut into shapes. 5. Bake in moderate oven till golden-brown.

Iced Fruit Drink.

1. Take a cupful each of strawberries, currants, stoned cherries. 2. Stalk fruit; mash to pulp with silver fork. 3. Add to fruit the strained juice of three lemons and half a tea cup of castor sugar. 4. Pour over two quarts of boiling water. 5. Let stand four hours or longer. 6. Strain off into a jug and put on ice till ready to serve.

Note.—The addition of a little brandy will preserve this for a longer time.

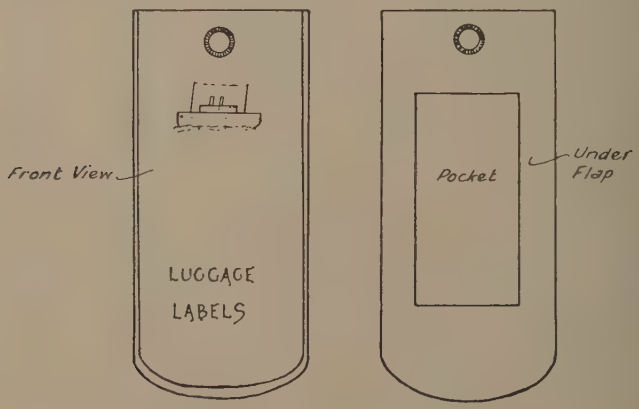
INEXPENSIVE CHRISTMAS FAVOURS.



A USEFUL BAG FOR HOUSEHOLD USE.

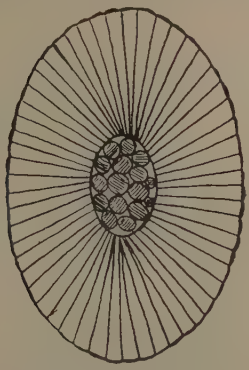
This is made of cretonne with letters appliqued on in white calico. It is really better made with washable material, such as holland, and lettering chain-stitched in colours. A rounded or straight coat hanger is slipped in the opened slit and left free. Any coloured binding may be used.

This is a useful bag for soiled handkerchiefs, string, or paper.



POCKET FOR LUGGAGE LABELS.

1. Take a strip of holland or crash about 14 inches long and 4 inches wide. Round off corners. 2. Bind with coloured binding. Then double up and place a brass eyelet at folded end, or work a large eyelet. 3. Stitch an oblong pocket with fold inside on to under flap, having previously bound edge. 4. Finish off top flap with stitching. A railway train on rails or a ship make a good design for the stitching.



RAFFIA BROOCH.

1. Cut a piece of cardboard, oval shape, about 2 inches lengthways. Cut an oval-shaped hole in centre. 2. Bind over and under neatly with straw-coloured raffia, and finish securely. 3. Make a tuft of tiny flowers in coloured raffia for centre. 4. Fix a large safety pin at back—like a brooch.

TO COVER SHOE-TREES.

1. *Materials.*—Shoe-trees, gold paint outfit: 1 yd. of, say, saxe-blue ribbon 1in. wide; 1 yd. of cerise ribbon 1in. wide; narrow strip of calico, etc., for binding.

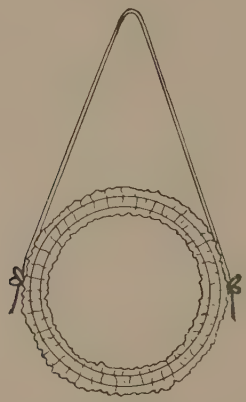
2. Paint ends of shoe-trees with gold paint. (Outfit costs 1s., and does several pairs).

3. Bind steel of trees neatly.

4. Place half-yards of coloured ribbons on each other and neatly join down one edge with running stitch.

5. Slip tree in between ribbons and n atly join other edge with running stitch, gathering up ribbon as this is done.

6. Secure both ends neatly and decorate shoe-tree with tiny posy or ribbon-bow.



STOCKING RING.

1. A fancy work frame makes a very nice stocking ring when covered with gathered ribbon.

2. A ring of 6in. diameter takes 1 yd. of 1¼in. ribbon and 1 yd. of ¾in. ribbon (two colours if preferred).

3. Lay the narrow ribbon on the wider one and stitch one side

4. Now place the ring between the ribbons and sew the ribbons together over the ring, gathering at the same time.

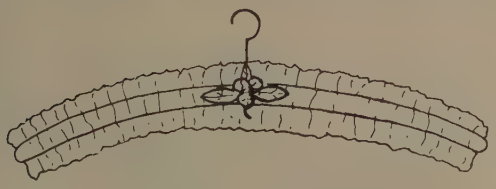
5. Make a ribbon handle and attach to top of ring with a posy of flowers at each side.

TIE RING.

1. A tie ring may be covered with raffia by just folding raffia round ring.

2. One, two, or three-coloured raffia may be used.

3. Handle to be made of plaited raffia and attached at sides with bow of mixed raffias.



TO COVER COAT HANGER.

1. Materials required: coat hanger, cotton wool or binding material, one-eighth yd. of coloured Jap silk, posy or ribbon decorations.

2. Cover hanger with cotton wool or bind tightly with some strong material.

3. Take a piece of coloured silk about 30in. in length and about 4in. to 5in. wide, and turn in raw edges and neatly sew with running stitch.

4. Cut a small hole in centre of folded edges and slip silk on coat hanger.

5. Run a frill above and below wood by small running stitches, gathering up tightly.

6. Decorate with posy of fruit, etc., in centre.

7. A lavender bag may be hung from centre.

LIVE STOCK AND MEAT.

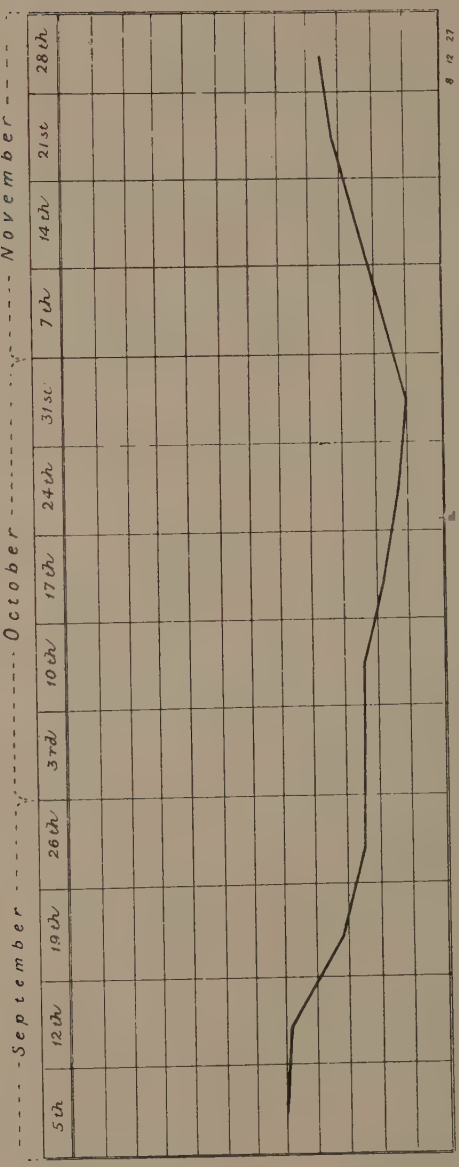
For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKET FOR MONTHS OF SEPTEMBER, OCTOBER AND NOVEMBER, 1927.

	September.				October.				November.				
	7	14.	21.	28.	5.	12.	19.	26.	2.	9.	16.	23.	30.
Sheep and Lambs	13,252	11,278	8,878	12,044	12,675	12,496	12,951	14,445	15,118	14,252	12,411	11,767	16,161
Cattle ...	388	439	615	747	632	673	873	696	708	831	786	790	552
Pigs	802	602	891	947	559	840	877	781	552	818	633	569	528

COMPARATIVE VALUES PER LB. OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS DURING MONTHS OF SEPTEMBER, OCTOBER AND NOVEMBER, 1927.

	September.				October.				November.				
	7.	14.	21.	28.	5.	12.	19.	26.	2.	9.	16.	23.	30.
Mutton ...	8½	8½	8½	8½	7½	7½	4½ (shorn)	4½ (shorn)	4½ (shorn)	4½ (shorn)	4½ (shorn)	5 (shorn)	5 (shorn)
Beef	5½	6½	7	6	6	6½	5	5½	5½	5½	5½	5½	5½
Pork	11½	12	11½	11½	11½	11	11	11	11½	11	1/–	11½	11½
Bacon- ...	10½	10½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9	9



Compiled from figures kindly supplied by the Co-Operative Wheat Pool of Western Australia

MARKET REPORT.

The following particulars of the approximate quantity of chaff available for auction at the metropolitan chaff and grain sales, held in Perth during the months of September, October, and November; also the minimum and maximum prices ruling for f.a.q. to prime wheaten, have been supplied by Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth:—

September—

Quantity—1,500 tons.
Maximum price—£8.
Minimum price—£6 10s.

October—

Quantity—1,950 tons.
Maximum price—£8.
Minimum price—£6 5s.

November—

Quantity—1,850 tons.
Maximum price—£6 5s.
Minimum price—£5.

The first consignments of new season's ex the hay districts began to arrive on the 20th of October, and the market gradually receded to £5 per ton. From information gathered, there appears to be fairly large quantities of hay cut. The reason no doubt for this is that at about hay-making time a considerable quantity of chaff was being shipped to New South Wales, and farmers, anticipating high prices, cut large quantities. However, around that time good rains were experienced in the Eastern States, and the demand fell off, it being impossible at the moment to do business. Future prices depend largely on whether export is possible, but present indications are not favourable. The market at time of writing, owing chiefly to the truck shortage, is a little firmer, f.a.q. to prime wheaten being worth £5 5s. per ton.

Oaten Chaff.—During the past few weeks supplies have been extremely short, and consignments of prime green oaten have at times exceeded the price of prime wheaten by 7s. 6d. per ton. At the present time, prime quality is worth from £5 7s. 6d. to £5 10s. per ton; f.a.q. £5; good mediums £4 15s.

Oats.—Very few consignments were available during September and October, and as high as 4s. 11d. per bushel was secured for good samples. However, immediately new season's became available, prices gradually receded, good heavy feeds now being worth about 3s. per bushel. A few weeks ago some sales were made to the Eastern States, but recently inquiries have fallen off, Melbourne and Sydney being able to land oats from other places cheaper than from here.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	SEPTEMBER.						OCTOBER.						NOVEMBER.					
					inches.	inches.					inches.	inches					inches.	inches
Chapman Experiment Farm	70·4	81·5	48·7	41·9	2·21	1·67	76·0	88·5	50·3	43·4	·85	1·00	85·7	105·5	55·5	47·4	·08	·28
Geraldton	73·1	86·0	54·8	46·0	2·13	1·38	74·9	90·0	57·0	46·0	·64	·72	76·9	104·0	58·6	48·3	·33	·26
Walebing	68·4	80·2	46·1	35·0	1·55	2·22	75·2	96·4	47·0	39·4	1·40	1·35	85·9	103·4	52·4	46·2	·15	·55
Perth	68·5	80·0	52·2	43·8	3·93	3·41	71·3	86·1	53·5	45·0	2·67	2·21	77·0	94·0	57·3	49·0	·43	·81
Kalamunda	68·8	76·0	52·2	45·0	4·47	4·70	71·8	86·6	53·3	42·6	2·24	3·37	78·5	94·6	55·0	47·0	·13	1·13
Bunbury		Not received.				3·72		Not received.				2·49	74·5	87·2	54·4	44·2	·53	1·04
Bridgetown	67·1	78·0	43·3	33·9	4·94	3·91	70·5	87·0	45·0	35·5	2·47	3·09	80·9	95·9	47·3	37·5	·18	1·16
Albany	63·9	75·4	50·6	42·0	7·34	4·04	66·2	85·4	50·5	45·0	3·18	3·27	70·5	83·6	53·7	44·0	·59	1·36
Merredin Experiment Farm	68·8	82·0	46·1	32·1	1·67	0·96	75·6	87·6	48·4	40·2	·64	·85	86·6	101·8	54·2	45·6	·19	·39
Northam	67·7	84·2	46·0	35·1	1·15	1·65	74·9	88·2	48·5	39·5	·65	1·00	84·9	104·5	55·2	45·8	·16	·41
York	69·3	81·0	45·2	34·2	1·31	1·64	74·7	90·0	45·6	37·2	·69	1·05	84·8	101·0	52·4	44·0	·17	·44
Narrogin School of Agriculture	65·4	75·0	44·0	37·0	2·47	2·33	70·3	83·4	45·1	37·0	1·80	1·50	82·4	96·8	49·5	41·2	·25	·59
Katanning	65·1	76·7	45·8	38·0	2·28	1·95	69·6	83·0	46·5	37·4	1·82	1·61	80·9	96·3	50·5	43·0	·27	·64
Cape Leeuwin ...	63·2	73·0	53·1	47·5	9·12	3·23	64·6	77·0	55·1	51·0	2·60	2·96	70·0	77·0	58·2	53·0	·34	1·27

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